History of Burner/Nozzle Replacements at IGS

Year	Unit 1	Unit 2
1986	Initial operation with the original B&W Mark IV Low NOx (DRB) Dual Register Burners installed with initial construction. 22" alloy seam tip. CS conical diffuser	
1987		Initial operation with the original B&W Mark IV Low NOx (DRB) Dual Register Burners installed with initial construction. 22" alloy seam tip. CS conical diffuser
1991		Repaired and modified the burners. Structural modifications to the backplate and registers to prevent warping from overheat. Conical diffusers used. Flame stabilizers installed to shade the burner front from radiant heat. HD registers
1992	New B&W Dual Register Phase 5 Low NOx burners installed. Structural modifications to the backplate and registers (HD registers) to prevent warping from overheat. Carbide conical diffuser used. Flame stabilizers installed to shade the burner front from radiant heat. Overheating was the result of design flaws from B&W. 33" seamless alloy tip used.	
1998		All nozzles replaced with a 63" ceramic lined section with a 33" centrifugally cast PI-2000 heat and abrasion resistant tip. Nitride Bonded Silicon Carbide Conical diffuser 4-98
1999	All nozzles replaced with a 63" ceramic lined section with a 33" centrifugally cast PI-2000 heat and abrasion resistant tip. Nitride Bonded Silicon Carbide Conical diffuser 4-99	
2004		New burners installed due to structural failures from overheating. Unit 2 failed before Unit 1 because Unit 2's were not replaced in 1992 which was the case for Unit 1. Advanced Burner Technologies (ABT) Opti-flow Low NOx flame Stabilization nozzle (flower pedal shaped) tip. 28" cast tip. X-vane installed in a spool piece and a kicker in the elbow installed. No conical diffuser.
2006		Repaired and modified the ABT burners. Tip wear liners installed along with a fuel injector diffuser and wear liner. Elbow kicker removed. Modifications due to holes in nozzles at 3 o'clock and 9 o'clock positions from x-vane, holes through sweep elbows, and tips eroded through and cracked. 15 tips irrepairable and replaced with a 40" straight tip section.

History of Burner/Nozzle Replacements at IGS

Year	Unit 1	Unit 2
2007	Replacement nozzles 81" ceramic lined with 44" cast PI-2000 heat and abrasion resistant tip. Nitride Bonded silicon Carbide Conical Diffusers used. G1 and F4 new nozzles installed. Replaced coal deflector struts due to erosion and worn U brackets for conical diffuser .	
2008		New injectors and elbows installed per an agreement with Siemens due to structural failures on ABT burners installed in 2004. Replaced ABT injector with new design of ABT Opti-Flow Injectors on all 48 burners. This included tip designed for more flow and smaller impact angle with the ridges plasma coated for erosion. The coal pipe was ceramic lined with a 309 SS piece as a transition from coal pipe to tip. Installed flat back elbow with integral fuel distributor on all 48 burners. Repaired air flow divider cylinders.
2009	C5 new nozzle installed due to erosion holes in carbon steel area. Three other burners found with holes through the nozzle. A4 out on carbon steel area and C3 and H3 had a hole at area above the conical diffuser. Replaced coal deflector struts due to erosion and worn U brackets for conical diffuser as well as many had ceramic tile broken or missing. RTV'd in front of u-clips as well as deflector gap. 29 burners worked on. 7 were pulled for deflector bolt eroded through.	

Intermountain Generating Station
Unit 2 Burner Injector and Burner Elbow Replacement

<u>Project Description</u>
Replacement of all 48 burner elbows and burner injectors.

The existing burner injectors and burner elbows will be replaced with new injectors and sweep elbows provided by Siemens. The replaced injectors and elbows will be removed from the unit to a designated area. Burners are located on the 5th through the 8th level on the unit.

<u>Scope of Work</u>.:

1. Removal of old burner elbow on all 48 burners. (Just like 2006 outage)
    a. Removal of welded TC from burner pipe.
    b. Install needed rigging for burner pipe support.
    c. Burner elbow removal by row.
    d. Removal of old elbows to designated area outside of unit.
    e. Clean flange mating surface.

2. Removal of old burner injector on all 48 burners. (Just like 2006 outage, 2000 # each)
    a. Removal of lagging and insulation needed to unbolt injector.
        i. Can happen at earlier sequence.
    b. Unbolt injector and pull out of burner. Clean ash before pulling injector out.
    c. Removal of old injectors to designated area outside of unit.

3. Clean up burner casing prior to installation of new injector.
    a. Guzzle up all ash in burner casing and all ash that has fallen into burner secondary air opening.
    b. Repair burner casings as needed. ** Inspection 2 years ago showed damage on several burner casings per row. We will not know the extent of repairs needed until injector pulled.

4. Installation of 48 new burner injectors.
    a. Unload upon arrival and mobilize new burner injectors to appropriate burner rows.
    b. Install new burner injectors by sliding into burner casing and bolting up to burner housing with gasket material.
    c. Install insulation and lagging. (Can be installed after elbow installation)

5. Installation of 48 new flat back burner elbows.
    a. Unload upon arrival and mobilize new burner flat back elbows to appropriate burner rows.
    b. Position and bolt up 48 new burner elbows with gasket material.

6. General cleanup following completion of installation.

7. Painting
   a. After completion of installation (April 21, 2008 at 07:00) IPSC painters to prep elbows and paint. Stencil elbows for identification. i.e. C-1, C-2,....

8. Schedule:
   a. Injectors and flat back elbows:
      i. <u>Start of work</u>: March 28, 2008 or as soon as required materials are on site.
      ii. <u>Completion</u>: Installation and inspections of burner injector and elbows by April 21, 2008 at 07:00

9. Materials:
   a. Materials to be supplied by Siemens.
      i. Burner fuel injector.
      ii. Flat back elbows with x-vane.
   b. Material s supplied by IPSC.
      i. Gasket material for burner elbow flanges.
      ii. Gasket material for injector to burner housing.
      iii. 253 MA material to repair burner casings.
   c. The contractor shall be responsible for providing weld rod, all additional parts, tools, and/or materials including insulation and lagging required for the completion of this job.

Intermountain Generating Station
Unit 2 Burner Injector and Burner Elbow Replacement

Project Description
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The existing burner injectors and burner elbows will be replaced with new injectors and sweep elbows provided by Siemens. The replaced injectors and elbows will be removed from the unit to a designated area. Burners are located on the 5th through the 8th level on the unit.

Scope of Work.:

1. Removal of old burner elbow on all 48 burners. (Just like 2006 outage)
    a. Removal of welded TC from burner pipe.
    b. Install needed rigging for burner pipe support.
    c. Burner elbow removal by row.
    d. Removal of old elbows to designated area outside of unit.

2. Removal of old burner injector on all 48 burners. (Just like 2006 outage, 2000 # each)
    a. Removal of lagging and insulation needed to unbolt injector.
        i. Can happen at earlier sequence.
    b. Unbolt injector and pull out of burner.
    c. Removal of old injectors to designated area outside of unit.

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    a. Guzzle up all ash in burner casing and all ash that has fallen into burner secondary air opening.
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4. Installation of 48 new burner injectors.
    a. Mobilize new burner injectors to appropriate burner rows.
    b. Install new burner injectors by sliding into burner casing and bolting up to burner housing with gasket material.
    c. Install insulation and lagging. (Can be installed after elbow installation)

5. Installation of 48 new flat back burner elbows.
    a. Mobilize new burner flat back elbows to appropriate burner rows.
    b. Position and bolt up 48 new burner elbows with gasket material.

6. General cleanup following.

7. Schedule:
    a. Injectors and flat back elbows:
        i. Start of work: March 28, 2008 or as soon as required materials are on site.

ii. Completion: Installation and inspections of burner injector and elbows by April 21, 2008 at 07:00

8. Materials:
   a. Materials to be supplied by Siemens.
      i. Burner fuel injector.
      ii. Flat back elbows with x-vane.
   b. Material s supplied by IPSC.
      i. Gasket material for burner elbow flanges.
      ii. Gasket material for injector to burner housing.
      iii. 253 MA material to repair burner casings.
   c. The contractor shall be responsible for providing all additional parts, tools, and/or materials including insulation and lagging required for the completion of this job.

From: Garry Christensen
To: George Cross
CC: Dean Wood; Dennis Killian; Jerry Hintze
Date: 10/18/2007 10:16 AM
Subject: Burner flat back elbow prior cost quotation
Attachments: Garry Christensen.vcf

George, I was asked to inform you of the previous cost of the flat back elbows from a December 2, 2005 quote.

Ceramic lined elbows, complete with removable flat back and x-vane assembly and diffuser element and spool piece also included in package. $146,400 for 6 $24,400 each
for all 48 $1,171,200
+10% $1,288,320

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

From: Garry Christensen
To: Dean Wood; Jerry Hintze
Subject: Cost of fuel injector back in 11-05

During the meeting on 11-10-05 ABT offered the following:

Fuel Injector 24 @ $36,300 each plus and additional 12.5% discount if ordered within a time frame
48 @ $34,600 each plus and additional 15.0% discount if ordered within a time frame
Total for 48 fuel injectors $1,660,800 with discount 15% $1,411,680

From: "Moen, Noel S" <nsmoen@babcock.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 10/18/2007 2:37 PM
Subject: RE: Pulverizer-burner Coordination Curve question from Intermountain Power

Garry,

I don't know about the industry standards, but the companies I have dealt with usually factor in the barometric pressure and static.

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Thursday, October 18, 2007 2:44 PM
To: Moen, Noel S
Subject: RE: Pulverizer-burner Coordination Curve question fromIntermountain Power

Thanks Is it pretty much industry standard that the conversion from cfm to lbs/hr requires barometric pressure with static pressure and not just altitude correction?

>>> "Moen, Noel S" <nsmoen@babcock.com> 10/18/2007 12:29 PM >>>
Hi Garry,

The normal outlet pressure on mill contracts will be somewhere between 10 and 15 inches water pressure, depending on the burner pipe runs and diameter. Checking the burner pipe static on top of the mill would tell you what you have at IPP, but most of the contracts we have are set up for 15 inches.

Since we measure primary air flow on the inlet, and do not measure seal air flow and totalize this with primary air flow, the outlet CFM shown on the CIS does not factor in seal air.

Regards,

Noel Moen
Pulverizer Design
The Babcock & Wilcox Company
Telephone (330) 860-2116
FAX (330) 860-9302

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Thursday, October 18, 2007 1:13 PM
To: Moen, Noel S
Subject: Pulverizer-burner Coordination Curve question fromIntermountain Power

Noel, I have a question on the coordination curve for Intermountain CIS 101.05 (RB-614). On the sheet you can read the pulverizer air flow showing (MCFM @ 150F). This is the pulverizer outlet which is set for 150F but at what pressure is this flow? All air flow testing has used barometric pressure with static added into the equation. On the performance summary sheet I have not found a static pressure for pulverizer outlet. It does say predicted performance using 25.18 " hg.

Also, since this is at outlet, does the flow include seal air and moisture additions?
We are trying to get from cfm to lbs/hr flow from the sheet. Your help would be appreciated.

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

Air monitor

mill inlet

48.20" WC * 1 "Hg / 13.6 "WC = 3.544
25.50 " Hg barometric = 25.50
29.044 " Hg

Inlet Temp 239 °F

ρ = 0.0551 = ((25.50"Hg / 2.036 + 48.20"WC / 0.0361) * 144 * 28.965) / (1545.32) / (459.7 + 239))

Flow (lb/hr) = (cfm flow) * ρ (lb/ft³) * 60 min/hr

(65,132 cfm)(.0551)(60) = 215,326 lb/hr

velocity = CFM / area   total area 2.405 (6) = 14.4317 ft²

Alstom - barometric + coal pipe static press
mill outlet

B&W Clean air - barometric + coal pipe static
B&W original inlet - barometric + mill inlet static

Pulverizer-burner coordination curves
on curves are they calc'd with site specific barometric + static pressure

60 TPH * 6 = 360 total TPH   mills I/s to meet 6,600,000 lb/hr
51.4 TPH * 7 = 360 total TPH   using 11,010 BTU/lb coal
45 TPH * 8 = 360 total TPH

max per pulv 62.5 TPH @ 48 grind + 8.3% moisture
moisture 1 - (8.3-4)/100 = 0.957
HGI (48x2)/100 = 0.96

0.957 * 0.96 = 0.9187
68 TPH * 0.9187 = 62.47 TPH   124,940 lb/hr

to calculate CFM use density which uses static pressure

TOPS

IP7021690

265 kpph
239 kpph Apr 04 4-27-04 to 950 MW
265 kpph Jan 05
239 kpph 1-12-06
to present

62,000 cfm 7 pulv @ 6,600,000

+5% 65,100 cfm

@ 15" Static & 25.18 "Hg & 150°F ρ = 0.0571 lb/ft3

62,000 cfm * 0.0571 lb/ft3 * 60 min/hr = 212,412 lb/hr @ 51.0 TPH
75% fdr speed

	rotating	stationary
30 % fdr speed	45.9 mcfm	47.9 mcfm
100% fdr speed	61.2 mcfm	66.5 mcfm

@ max rate 125.12 mlb/hr (62.56 TPH) (92% fdr speed)
(32 ft3 air/lb coal) * (125,120 lb/hr coal) / 60 min/hr = 66,731 cfm
66,731 cfm * (0.0571 lb/ft3) * 60 min/hr = 228,620 lb/hr

@ 60 TPH (88.24 %)
(32.75 ft3 air/lb coal) (120,000 lb coal/hr)/(60) = 65,500 cfm
65,500 cfm * 0.0571 lb/ft3 * 60 = 224,403 lb/hr

@ 51.25 TPH (102,500 lb/hr) (75.37%)
(35 ft3 air/lb coal) * (102,500 lb coal/hr) / 60 = 59,792 cfm
59,792 cfm * 0.0571 lb/ft3 * 60 = 204,847 lb/hr

@ 45 TPH (90,000 lb/hr) (66.18%)
(36.8 ft3 air/lb coal) * (90,000 lb coal/hr) /60 = 55,200 cfm
55,200 cfm * 0.0571 lb/ft3 * 60 = 189,115 lb/hr

min 22.8 TPH (45,621 lb/hr) (33.5 % fdr speed)
(65 ft3 air/lb coal (45,621) / 60 = 49,423 cfm
49,423 cfm * 0.0571 lb/ft3 * 60 = 169,323 lb/hr

33.82% @ 23 TPH (46,000 lb/hr) (65 ft3 air/lb coal) / 60 = 49,833 cfm
(49,833 cfm) (.0571 lb/ft3) * 60 = 170,728 lb/hr

From: Garry Christensen
To: George Cross
CC: Dean Wood; Dennis Killian; Jerry Hintze
Date: 10/18/2007 10:16 AM
Subject: Burner flat back elbow prior cost quotation
Attachments: Garry Christensen.vcf

George, I was asked to inform you of the previous cost of the flat back elbows from a December 2, 2005 quote.

Ceramic lined elbows, complete with removable flat back and x-vane assembly and diffuser element and spool piece also included in package. $146,400 for 6 $24,400 each
for all 48 $1,171,200
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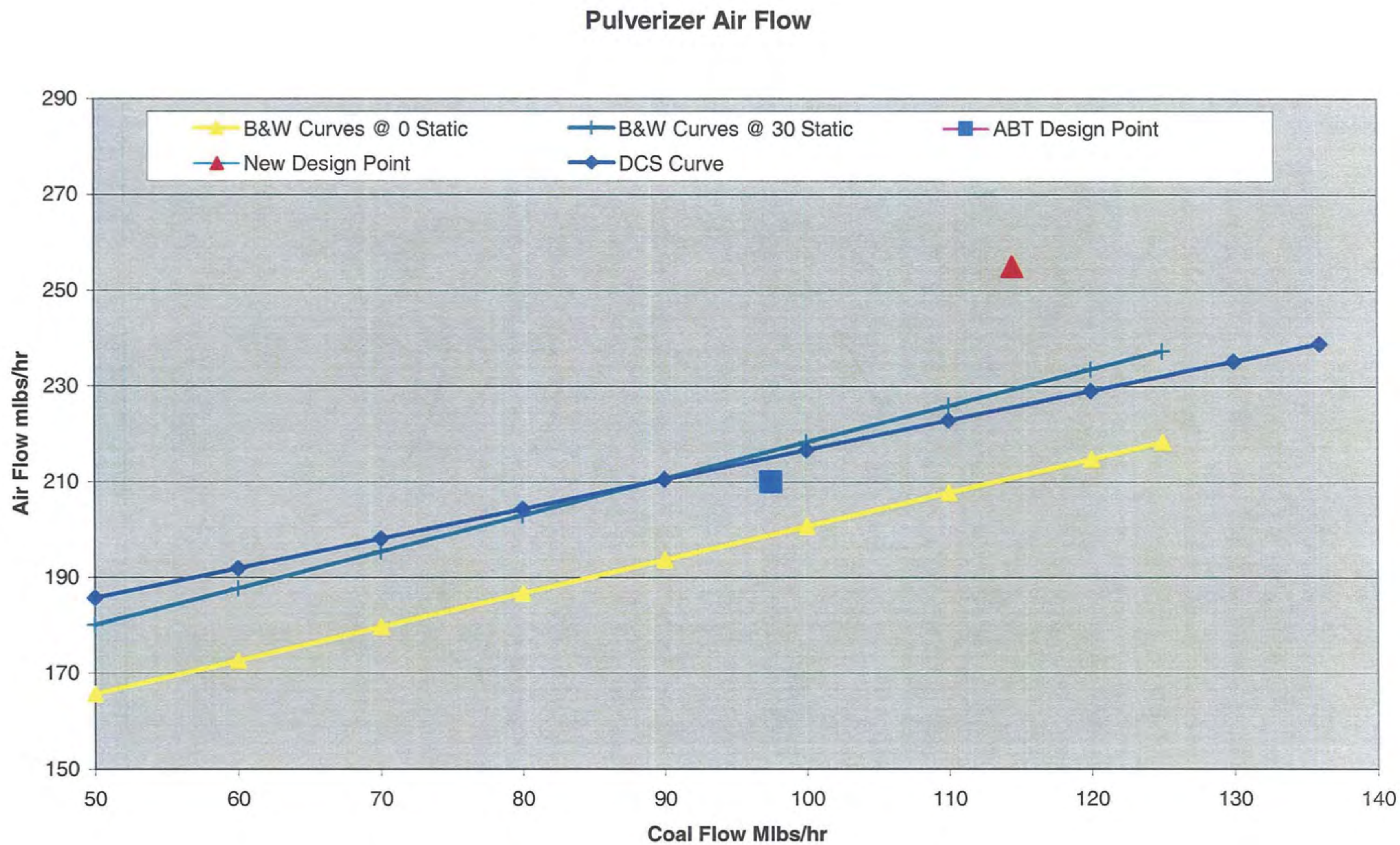

Pulverizer Air Flow
B&W Curves @ 0 Static
B&W Curves @ 30 Static
ABT Design Point
New Design Point
DCS Curve
Air Flow mlbs/hr
Coal Flow Mlbs/hr
290
270
250
230
210
190
170
150
50
60
70
80
90
100
110
120
130
140

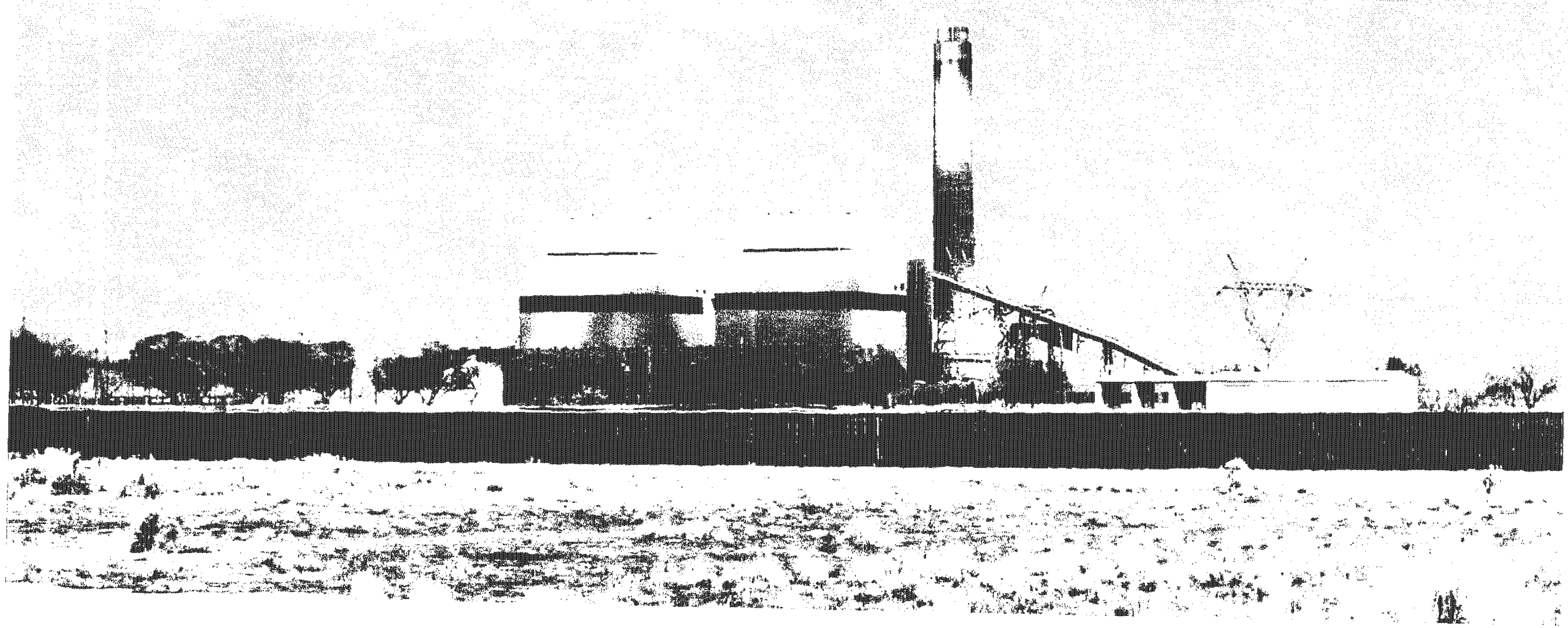
IP7021693

Intermountain Power Service Corp.
ABT Siemens Warranty Claim

SIEMENS

Unit #2 - 950 MW

Plant Location – Delta Utah



Date: October 17, 2007

SIEMENS

ABT was awarded a contract in 2003 for the material supply of low NOx burners replacing existing B&W burners that had operated since 1992.

The base contract was for material supply only of 48 low NOx burners, 48 ABB Scanners plus air flow measuring equipment.

Approximately one year after commercial operation, the unit suffered a fire in one burner that destroyed the fuel injector. During the following Spring outage, Inspection revealed additional nozzles had cracks and excessive thinning of the fuel piping and nozzles.

April 2007, Siemens BTS and IPSC initiated a Six Sigma investigation to determine the root cause of the of the problems with the burners.

Siemens BTS and IPSC agreed on an issue statement with the five items:

1.) The alloy nozzle tip is cracking
2.) There is material loss at the following locations:
    - The burner nozzle tip
    - The "X" vane at the coal pipe elbow
    - The burner barrel
3.) The burner barrel is experiencing permanent deformation
4.) Establish the correct primary airflow for normal operation
5.) Definition of requirements for cooling air when the burner is out of service

SIEMENS

The Six Sigma Root Cause analysis followed the five steps for a Six Sigma Project

Define: clear definition of the problem and the aim of the project

During the define stage, all available correspondence was collected, contract documents were collected, the involved parties were interviewed and an Issue Statement developed and agreed to.

Measure: Examination of the current process and collection relevant data for future analysis

The ABT design records were reviewed, the existing pulverizer performance at IPSC was documented and metallurgical analysis of the cracked burner nozzle was performed.

Analyze: Evaluation of the measured results and identification of the actual cause of the problem

CFD analysis and thermal modeling of the nozzles using the operating parameters as measured during the pulverizer testing was performed. A root cause analysis was generated.

Improve: Selection and implementation of the solution

A new burner design was generated using the information collected during the Define and Measure stage and CFD analysis undertaken to verify changes will

Control: Control of the changed process

The differences between the original design and the revised design need to be implemented and documented

SIEMENS

Executive Summary

The alloy nozzle tip cracking is the result of erosion of the wall thickness in the nozzle due to higher than original air and coal flow. The thinner wall section weakened the nozzle to the point that the nozzle could not accommodate the stress generated by the differential expansion between the stainless steel nozzle and the carbon steel barrel.

There is material loss at the burner nozzle tip, "X" vane at the coal pipe elbow and the burner barrel are a result of coal and air flows being higher than design plus stratification of the coal particles in the coal pipe entering the 90° elbow.

The burner barrel is experiencing permanent deformation due to higher than expected temperatures at the interface between the nozzle and barrel. The burner barrel will use a SS spool piece to extend back into the burner barrel.

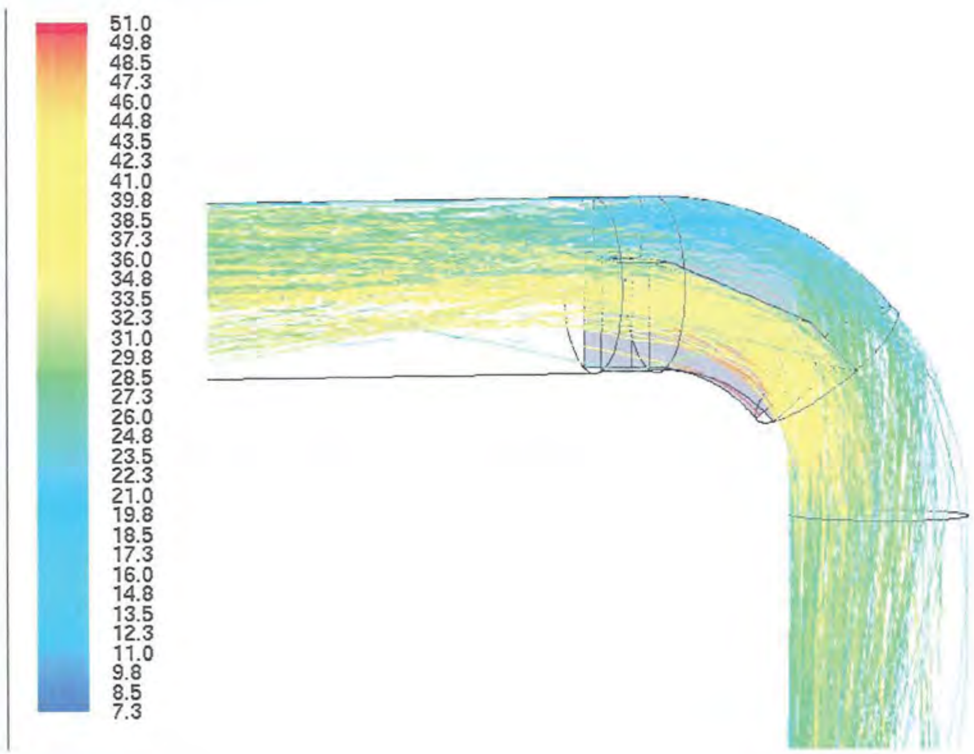
Establish the correct primary airflow for normal operation – The plant has not been operating per the B&W mill performance curve supplied in the contract. The mill curve supplied in the contract did not reflect the revision by B&W in 1992. Also, the plant has been operating at higher seal air flows

Definition of requirements for cooling air when the burner is out of service – the Operations and Maintenance manual will have to be revised to address out of service operation

Intermountain Power Service Corp
ABT Siemens Warranty Claim

SIEMENS

Erosion and Mill Air Flow



The CFD model shows the coal particles are stratified entering the elbow. The original kicker assembly with the X-vane that was modified to retain the clean out port will not last in the high velocity stream of concentrated coal particles with the higher coal flow.

The revised fuel injector design will increase the cross sectional area of the nozzle to reduce velocities, lengthen and flatten the slope of the transition ramp and replace the round elbow with a "Flat back" design to allow dispersion of the coal particles across the flow area of the nozzle.

Intermountain Power Service Corp
ABT Siemens Warranty Claim

SIEMENS

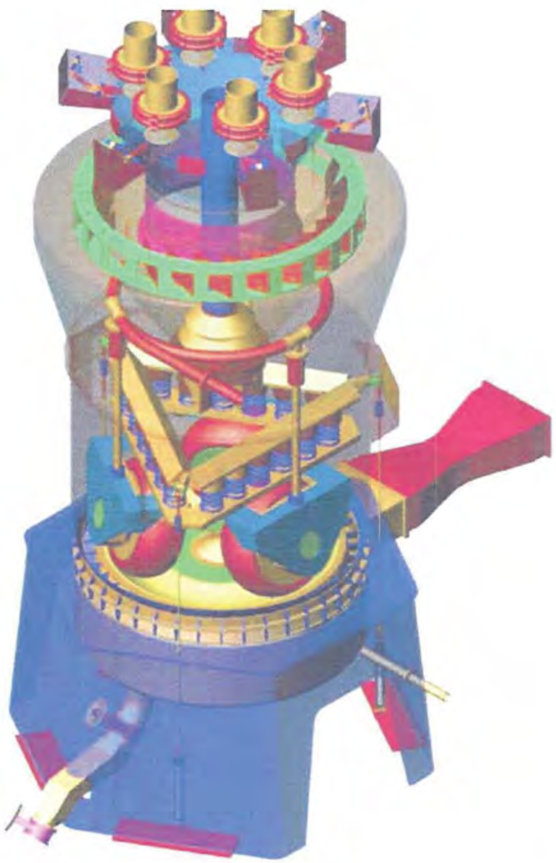
Erosion and Mill Air Flow

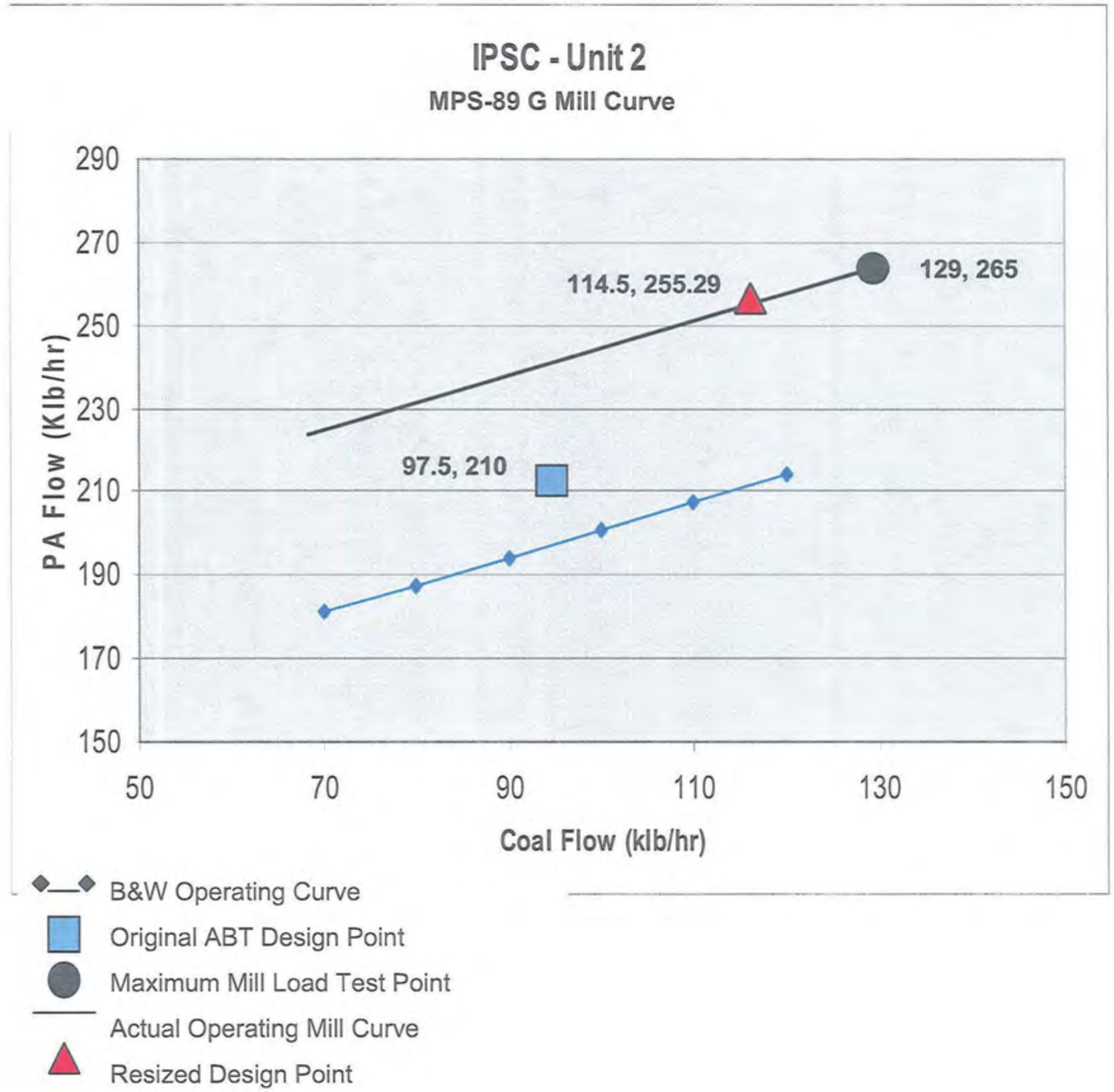
Erosion is originating at the transition slope from the round barrel to the 6 lobe exit. This is consistent with the results of the CFD model. The metallurgical analysis performed by Tordonato Energy Consultants identified erosion as a the contributor cause of the nozzle cracking. The high temperatures at the weld between the nozzle and burner barrel increased the stress which also contributed to the cracking. There was no evidence of corrosion.

Intermountain Power Service Corp
ABT Siemens Warranty Claim

SIEMENS

Erosion and Mill Air Flow

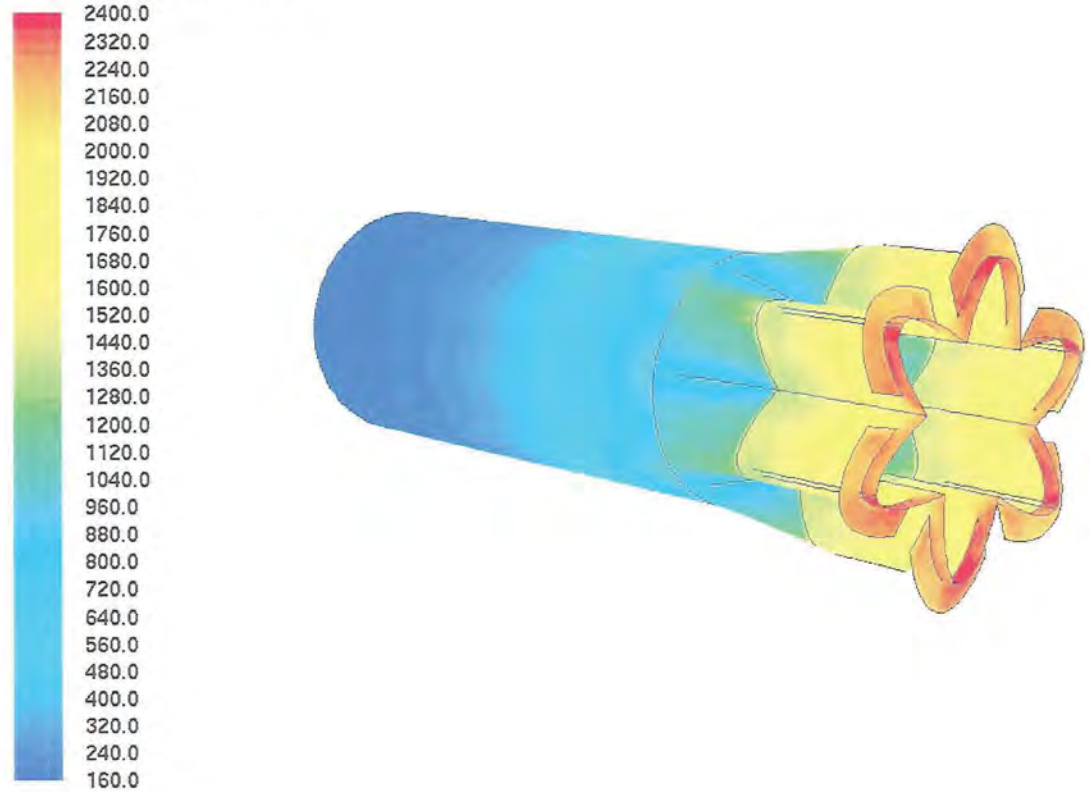




SIEMENS

Intermountain Power Service Corp
ABT Siemens Warranty Claim

Thermal Stress



Contours of Static Temperature (f)

Sep 26, 2007
FLUENT 6.3 (3d, pbns, pdf20, rke)

The furnace radiation model shows that the heat conducted back to the burner barrel to be higher than expected. The revised fuel injector will use a spool piece of 253MA stainless steel to make the transition from the nozzle to the barrel. The revised fuel injector shall use refractory tile to shield the burner barrel from radiation from the furnace and to minimize erosion. This thermal model does not model the cooling of the secondary air on the tip.

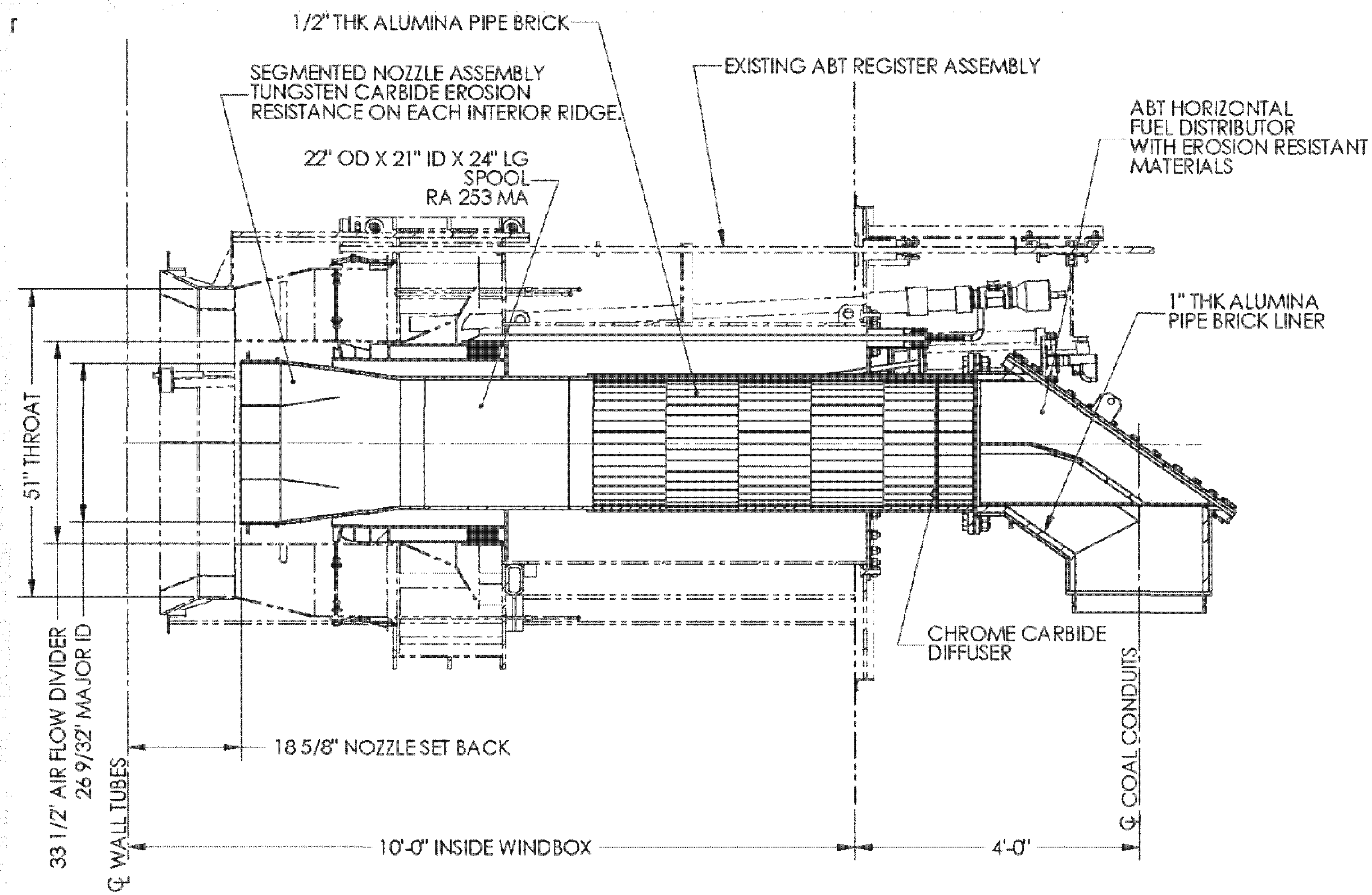
SIEMENS

Thermal Stress

The off line burners are plugging with slag indicating that furnace gases are back flowing into the nozzle area. This creates very high temperatures that the nozzles were not designed for. A minimum air flow required to prevent this must maintained.

IP7021702

SIEMENS



1/2" THK ALUMINA PIPE BRICK
SEGMENTED NOZZLE ASSEMBLY
TUNGSTEN CARBIDE EROSION
RESISTANCE ON EACH INTERIOR RIDGE.
22" OD X 21" ID X 24" LG
SPOOL
RA 253 MA
EXISTING ABT REGISTER ASSEMBLY
ABT HORIZONTAL
FUEL DISTRIBUTOR
WITH EROSION RESISTANT
MATERIALS
1" THK ALUMINA
PIPE BRICK LINER
51" THROAT
33 1/2" AIR FLOW DIVIDER
26 9/32" MAJOR ID
℄ WALL TUBES
CHROME CARBIDE
DIFFUSER
℄ COAL CONDUITS
18 5/8" NOZZLE SET BACK
10'-0" INSIDE WINDBOX
4'-0"

SIEMENS

Next Steps

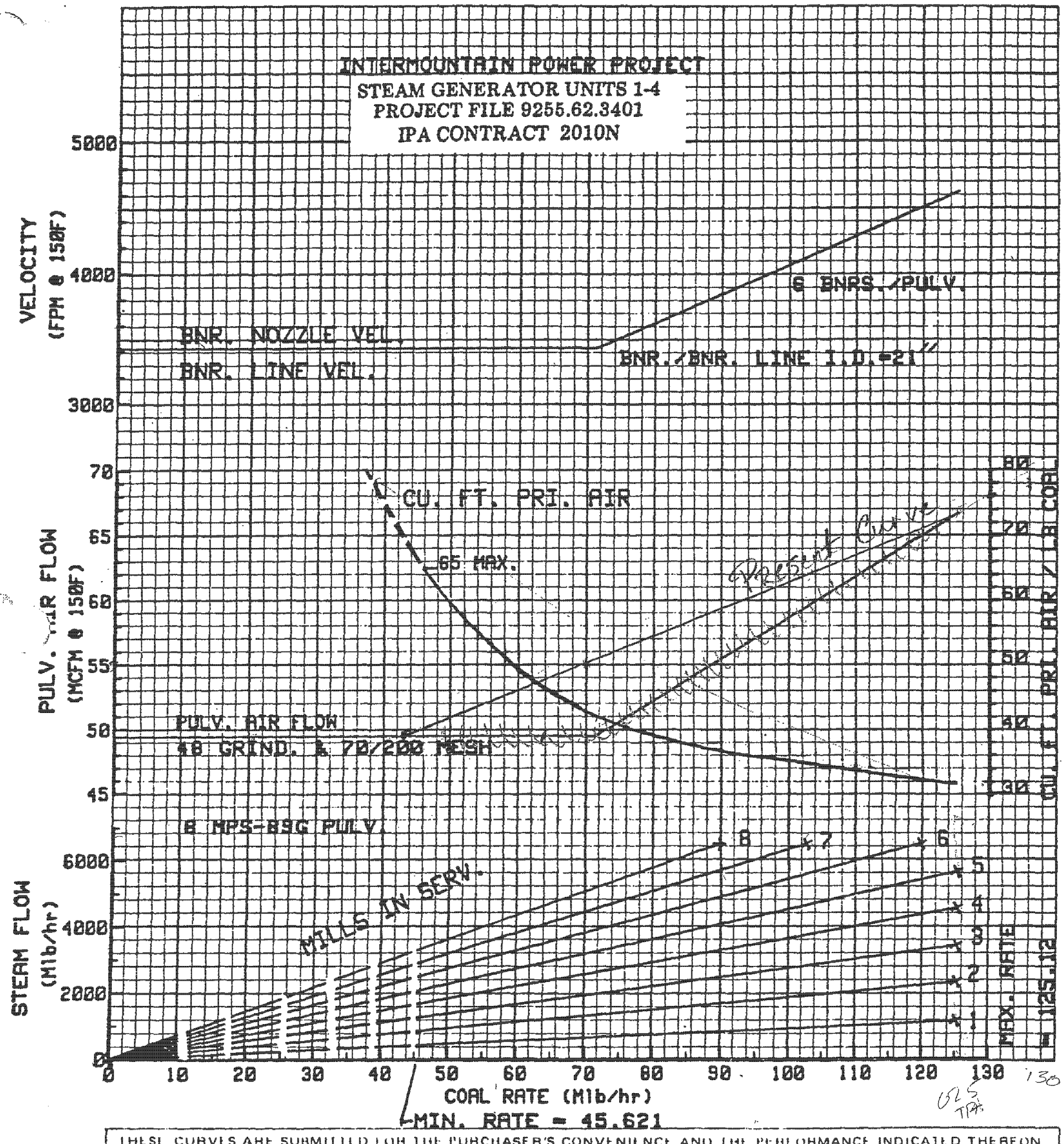
Close Out Six Sigma Program

- Commercial agreement between IPSC and Siemens Power Generation Inc
- Agreement on Division of Responsibilities

PG 896-4

Babcock & Wilcox

CONTRACT INFORMATION SHEET



THESE CURVES ARE SUBMITTED FOR THE PURCHASER'S CONVENIENCE AND THE PERFORMANCE INDICATED THEREON SHALL NOT BE OFFERED BY THE COMPANY OR CONSTRUED BY THE PURCHASER AS A PROPOSAL OR CONTRACT OBLIGATION.

DRAWN BY	DATE	APPROVED BY	DATE	A.O.
J. NEIDERT	2-1-82	RSHP	2-5-82	

REL. NO. AND DATE	CONTRACT NO.	FILE NO.
1 9-8-82	334-0614	RB-614

TITLE — PULVERIZER-BURNER COORDINATION CURVES - COAL (B)

CIS— 101.05

IP7021705

From: "Moen, Noel S" <nsmoen@babcock.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 10/24/2007 7:01 AM
Subject: RE: CIS Curve

Garry,

As we discussed on the phone, your current measurement of primary air flow is by mass flow on the mill inlet duct with the measuring device. This is an acceptable method and preferred for measuring and controlling primary air flow and consequently for setting up a loading curve for the mill. Specifically, your B&W 89G mills are designed for 239,000 #/hr primary air flow when the mill is at maximum capacity. Obviously, with coal lower than 50 HGI, the 136,000 #/hr maximum grinding capacity has to be adjusted. In general, the maximum grinding capacity degrades 2% for every point below 50, down to around 30 HGI (after which the correction is not linear).

Mill outlet CFM can conveniently calculate burner line velocity, and has been shown on previous CI Sheets. To convert from mass flow to CFM, we use the mass flow at the measured point and use temperature and barometric/static pressure at the alternate point to get volume flow. For instance, a general correction would take the barometric pressure for the plant elevation, measure static pressure and temperature at the mill outlet, and get an actual density of the air at the mill outlet. With the measured mass air flow at the inlet, the outlet volume is then determined.

Hopefully this answers your question.

Regards, Noel

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Tuesday, October 23, 2007 11:34 AM
To: Moen, Noel S
Subject: CIS Curve

Noel, sorry to keep bothering you but we need you to show us how to convert from the attached mill curve MCFM say at the top pulverizer flow 66.500 mcfm to lbs/hr. We are looking at this for our site. Thanks

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

Pulv Primary Air (lbs/hr) Test Flows (lb/hr)

Pulv	A	B	C	D	E	F	G	H	
PI	240,896	231,414		231,549	231,347	246,592	246,189	231,426	
Siemens cal'd	285,864	285,090		284,954	289,679	297,451	300,841	287,260	
by IPSC probe coeff 0.970									
w/probe coeff 0.928	273,865	272,746		272,616	277,136	284,572	287,814	274,822	
moisture evap	4,584	5,586		5,941	6,060	5,592	6,762	5,404	
seal air	15,874	15,874		15,874	15,874	15,874	15,874	15,874	
calc'c PA	253,407	251,286		250,801	255,202	263,106	265,178	253,544	
DCS vs Siemens	-5.19	-8.59		-8.31	-10.31	-6.70	-7.71	-9.56	ave -8.0[illegible]
PI	240,655	231,093	223,630	232,682	230,445	231,180	245,229	230,834	
Air Monitor traverse	243,946	243,554	231,590	239,639	243,405	243,396	258,191	243,815	
DCS vs Air Monitor	-1.37	-5.39	-3.56	-2.99	-5.62	-5.28	-5.29	-5.62	ave -4.3[illegible]

% deviation diff	A	B	C	D	E	F	G	H	
Siemens vs Air Monitor at same conditions	3.826	3.195			4.687		2.428	3.934	ave 3.66

C:\GC\Siemens\Air Monitor vs Siemens PA flows.xls

IP7021707

From: Garry Christensen
To: Robert J Allen
Date: 10/18/2007 9:39 AM
Subject: Questions brought up from presentation Oct 17, 2007
Attachments: Garry Christensen.vcf

Bob, the CFD model in the presentation (page 5) is for our existing sweep elbow and your proposal is to go to a flat-back elbow. Can we get a copy (similar to page 5) of the CFD model results from the run with the flat-back elbow with the view port? Several were wondering if the reason for going to the flat back design was for the view port only. I will probably have more questions but these were the first round. Thanks
PS Hope you start feeling well.

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

From: "Moen, Noel S" <nsmoen@babcock.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 10/18/2007 2:37 PM
Subject: RE: Pulverizer-burner Coordination Curve question from Intermountain Power

Garry,

I don't know about the industry standards, but the companies I have dealt with usually factor in the barometric pressure and static.

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Thursday, October 18, 2007 2:44 PM
To: Moen, Noel S
Subject: RE: Pulverizer-burner Coordination Curve question fromIntermountain Power

Thanks Is it pretty much industry standard that the conversion from cfm to lbs/hr requires barometric pressure with static pressure and not just altitude correction?

>>> "Moen, Noel S" <nsmoen@babcock.com> 10/18/2007 12:29 PM >>>
Hi Garry,

The normal outlet pressure on mill contracts will be somewhere between 10 and 15 inches water pressure, depending on the burner pipe runs and diameter. Checking the burner pipe static on top of the mill would tell you what you have at IPP, but most of the contracts we have are set up for 15 inches.

Since we measure primary air flow on the inlet, and do not measure seal air flow and totalize this with primary air flow, the outlet CFM shown on the CIS does not factor in seal air.

Regards,

Noel Moen
Pulverizer Design
The Babcock & Wilcox Company
Telephone (330) 860-2116
FAX (330) 860-9302

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Thursday, October 18, 2007 1:13 PM
To: Moen, Noel S
Subject: Pulverizer-burner Coordination Curve question fromIntermountain Power

Noel, I have a question on the coordination curve for Intermountain CIS 101.05 (RB-614). On the sheet you can read the pulverizer air flow showing (MCFM @ 150F). This is the pulverizer outlet which is set for 150F but at what pressure is this flow? All air flow testing has used barometric pressure with static added into the equation. On the performance summary sheet I have not found a static pressure for pulverizer outlet. It does say predicted performance using 25.18 " hg.

Also, since this is at outlet, does the flow include seal air and moisture additions?
We are trying to get from cfm to lbs/hr flow from the sheet. Your help would be appreciated.

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

From: "Moen, Noel S" <nsmoen@babcock.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 10/18/2007 12:30 PM
Subject: RE: Pulverizer-burner Coordination Curve question from Intermountain Power

Hi Garry,

The normal outlet pressure on mill contracts will be somewhere between 10 and 15 inches water pressure, depending on the burner pipe runs and diameter. Checking the burner pipe static on top of the mill would tell you what you have at IPP, but most of the contracts we have are set up for 15 inches.

Since we measure primary air flow on the inlet, and do not measure seal air flow and totalize this with primary air flow, the outlet CFM shown on the CIS does not factor in seal air.

Regards,

Noel Moen
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The Babcock & Wilcox Company
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-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Thursday, October 18, 2007 1:13 PM
To: Moen, Noel S
Subject: Pulverizer-burner Coordination Curve question fromIntermountain Power

Noel, I have a question on the coordination curve for Intermountain CIS 101.05 (RB-614). On the sheet you can read the pulverizer air flow showing (MCFM @ 150F). This is the pulverizer outlet which is set for 150F but at what pressure is this flow? All air flow testing has used barometric pressure with static added into the equation. On the performance summary sheet I have not found a static pressure for pulverizer outlet. It does say predicted performance using 25.18 " hg. Also, since this is at outlet, does the flow include seal air and moisture additions?
We are trying to get from cfm to lbs/hr flow from the sheet. Your help would be appreciated.

Intermountain Power Service Corp.
Performance Engineer
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garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

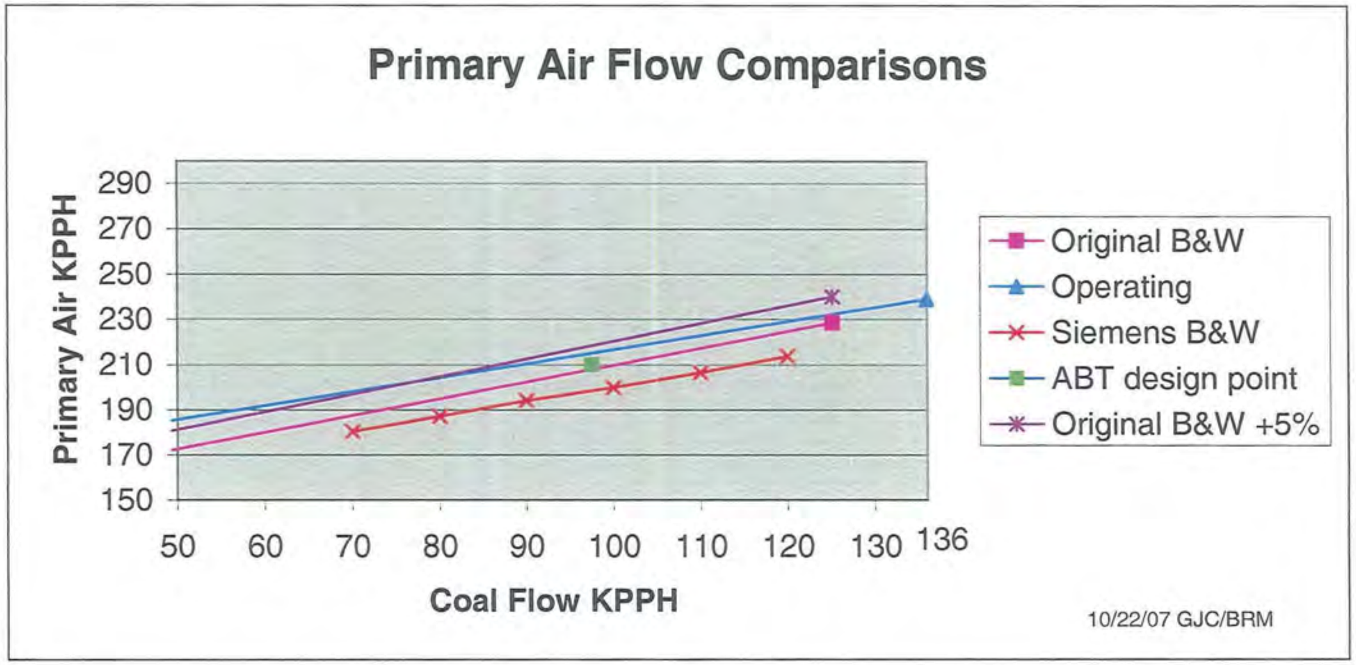
Intermountain Generating Station
Pulverizer Fineness Resul

	Skid Locked							
	2100 LBS	**2400 lbs**	**2400 lbs**	**2400 lbs**	**2400 lbs**	**2400 lbs**	**2400 lbs**	**2400 lbs**
B&W CCW throat port size	X Large	Large	Large	X Large	Large	X Large	X Large	X Large
Date Tested	7/18/2007	7/19/2007		7/20/2007	7/17/2007	7/18/2007	7/19/2007	7/20/2007
Unit	2	2	2	2	2	2	2	2
Mill	A	B	C	D	E	F	G	H
% Feeder Speed	85.0	90.0		90.0	90.0	90.0	90.0	90.0
Actual % Through 200 Mesh	64.7	70.6		70.4	70.4	65.0	67.5	63.2
Expected % Through 200 Mesh	59.6	68.4		68.7	60.8	62.8	67.7	65.3
HGI	41.4	47.1		47.5	42.5	43.5	47.1	45.0
Total Moisture	5.07	5.75		6.48	6.67	5.89	6.68	5.69
Air Dry Loss	3.93	4.55		4.83	4.91	4.57	5.48	4.44
As Received Btu	12,689	12,472		12,289	12,189	12,521	11,980	12,354
Test Period Average Data								
Test	2	4		6	1	3	5	7
Unit Pulv	2/A	2/B	2/C	2/D	2/E	2/F	2/G	2/H
% Feeder Speed	85.81	90.24	and End time	90.47	90.76	89.98	90.72	89.46
Actual Pulv Coal Flow (tph)	58.32	61.38	and End time	61.50	61.71	61.18	61.70	60.86
PA Control Damper Position (%)	98.92	78.17	and End time	74.69	87.66	84.54	94.53	90.23
Hot Air Damper Position (%)	40.13	41.11	and End time	37.11	37.70	40.09	35.94	35.39
Cold Air Damper Position (%)	60.00	58.71	and End time	62.81	61.84	59.69	64.13	64.33
PA Flow (%)	80.34	77.14	and End time	77.19	77.11	82.20	82.06	77.16
PA Inlet Damper Temp (DEGF)	282.55	300.49		293.47	290.01	315.63	318.10	309.32
Pulv D/P (INWC)	21.41	15.56		11.77	19.40	18.50	21.15	19.00
Disch Temp (DEGF)	149.92	150.25	and End time	150.36	149.92	150.12	150.09	150.20
Pulv Motor (amps)	61.22	69.56	and End time	72.04	64.30	65.85	64.29	69.88
Burner Line Velocity (ft/min)	4640	4398	and End time	4356	4429	4725	4751	4436
PA Mass Flow (kpph)	240.90	231.41	and End time	231.55	231.35	246.59	246.19	231.43
Pulv hrs since 30K Overhaul	4739	9338	and End time	12266	9851	11271	14094	10740
Pulv amp swing	6.33	8.95	and End time	11.07	9.09	5.23	6.38	8.68
PA Duct Pressure (INWC)	49.47	49.49	and End time	49.45	49.41	49.28	49.35	49.34
Skid Press Set Point	[-11059] No Good Data Fc	2400	and End time	2400	2399	2398	2400	Good Data Fc
Skid Press Feedback	10	2360		2442	2456	2392	2408	0
Coal Bias	0.0	0.0	and End time	0.0	0.0	0.0	0.0	0.0
Air Bias	5.0	0.0	and End time	0.0	0.0	5.0	5.0	0.0
Atmospheric Pressure (IN HG)	25.44	25.43		25.43	25.49	25.43	25.41	25.43
Ambient Temperature (Deg F)	81.63	81.50		79.15	86.80	94.95	95.20	93.26
Test	Locked	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI
Mill	A	B	C	D	E	F	G	H
* Contract % Through 200 Mesh @ 95% fdr speed	70	70	70	70	70	70	70	70
HGI Correction	0.828	0.941	#VALUE!	0.949	0.850	0.870	0.941	0.899
Moisture Correction	1.001	0.995	#VALUE!	0.992	0.991	0.994	0.985	0.996
Fineness Correction	1.159	1.025	#VALUE!	1.020	1.140	1.110	1.035	1.073
Expected % Through 200 Mesh (Good @ 65 tph only)	59.56	68.36	#VALUE!	68.72	60.83	62.84	67.74	65.31
Actual % Through 200 Mesh	64.70	70.60	0.00	70.40	70.40	65.00	67.50	63.20
Difference	5.14	2.24	#VALUE!	1.68	9.57	2.16	-0.24	-2.11
Ratio	108.64	103.3	#VALUE!	102.45	115.74	103.43	99.64	96.77
% Retained on 30 & 50 Mesh	0.0	0.4		0.2	0.2	0.1	0.1	0.0
Actual % Through 50 Mesh	99.0	98.7		99.3	99.3	99.1	99.4	99.3
Actual % Through 100 Mesh	95.8	96.5		97.3	97.1	95.4	96.4	95.2
Actual % Through 140 Mesh	83.8	87.2		87.5	87.6	83.4	85.1	82.0
Actual % Through 200 Mesh	64.7	70.6		70.4	70.4	65.0	67.5	63.2

*Contract coal - 48 HGI and air dry loss < 4%.

IP7021713

		x	y	x	y	x	y	x	y		
45.621	169.323	45.621	169.323	40.8	180	70	180.43	97.5	210	45.621	177.7892
46	170.728	125.12	228.62	136	239	80	187.17			125.12	240.051
90	189.115					90	194.17				
102.5	204.847					100	200				
120	224.403					110	206.67				
125.12	228.62					120	213.9				



IP7021714

Intermountain Generating Station
Primary Air Traverse Testing w/Air Monitor

B&W CCW throat port size	Large	Large	Large	X Large	X Large	X Large	X Large	X Large	X Large	X Large
Date Tested	8/14/2007	8/14/2007	8/14/2007	8/14/2007	8/14/2007	8/14/2007	8/15/2007	8/15/2007	8/15/2007	8/15/2007
Unit	2	2	2	2	2	2	2	2	2	2
Mill	2/E	2/E	2/E	2/F	2/F	2/F	2/G	2/G	2/H	2/H
% Feeder Speed	55	70	90	55	70	90	70	90	70	90
Test Period Average Data										
Test	1	2	3	4	5	6	7	8	9	10
Unit Pulv	2/E	2/E	2/E	2/F	2/F	2/F	2/G	2/G	2/H	2/H
% Feeder Speed	55.51	71.74	90.56	54.99	69.82	89.83	70.35	90.84	69.65	89.15
Actual Pulv Coal Flow (tph)	37.76	48.80	61.58	37.37	47.52	61.08	47.92	61.66	47.24	60.72
PA Control Damper Position (%)	62.29	66.99	77.55	60.52	64.49	73.14	72.47	83.59	72.79	83.57
Hot Air Damper Position (%)	29.93	32.32	35.38	29.91	32.92	38.02	30.29	35.60	31.65	35.77
Cold Air Damper Position (%)	70.21	67.10	63.92	70.18	66.87	61.59	70.20	64.69	68.50	64.19
PA Flow (%)	67.43	71.75	76.83	67.35	71.54	77.04	76.63	81.78	71.58	76.92
PA Inlet Damper Temp (DEGF)	244.08	262.69	283.82	255.51	276.93	308.75	269.79	298.48	278.41	306.78
Pulv D/P (INWC)	9.13	11.03	17.04	8.52	10.69	15.60	11.09	19.28	11.34	17.71
Disch Temp (DEGF)	150.16	149.93	149.93	149.96	150.00	150.17	149.22	148.85	150.12	150.18
Pulv Motor (amps)	62.09	65.47	63.84	69.59	72.72	73.96	65.43	65.80	70.46	70.74
Burner Line Velocity (ft/min)	3744	4003	4348	3737	3992	4361	4274	4650	4007	4376
PA Mass Flow (kpph)	202.461	215.353	230.445	202.077	214.643	231.184	229.900	245.229	214.822	230.834
Pulv hrs since 30K Overhaul	10514	10515	10516	11836	11837	11837	14728	14728	11356	11356
Pulv amp swing	12.19	13.37	10.63	7.96	9.50	9.97	13.31	7.82	11.08	8.60
PA Duct Pressure (INWC)	51.91	51.92	51.86	52.03	52.01	51.85	51.88	51.96	51.79	51.83
Skid Press Set Point	1787	2180	2400	1774	2149	2398	2162	2397	off	off
Skid Press Feedback	1844	2284	2540	0	43	2394	2298	2411	0	0
Coal Bias	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Air Bias	0.0	0.0	0.0	0.0	0.0	0.0	5.0	5.0	0.0	0.0
Atmospheric Pressure (IN HG)	25.52	25.52	25.52	25.51	25.50	25.50	25.49	25.49	25.50	25.49
Ambient Temperature (Deg F)	82.83	87.60	91.71	95.58	94.59	96.05	78.21	80.77	89.84	92.15
	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI

Intermountain Generating Station
Primary Air Traverse Testing w/Air Monitor

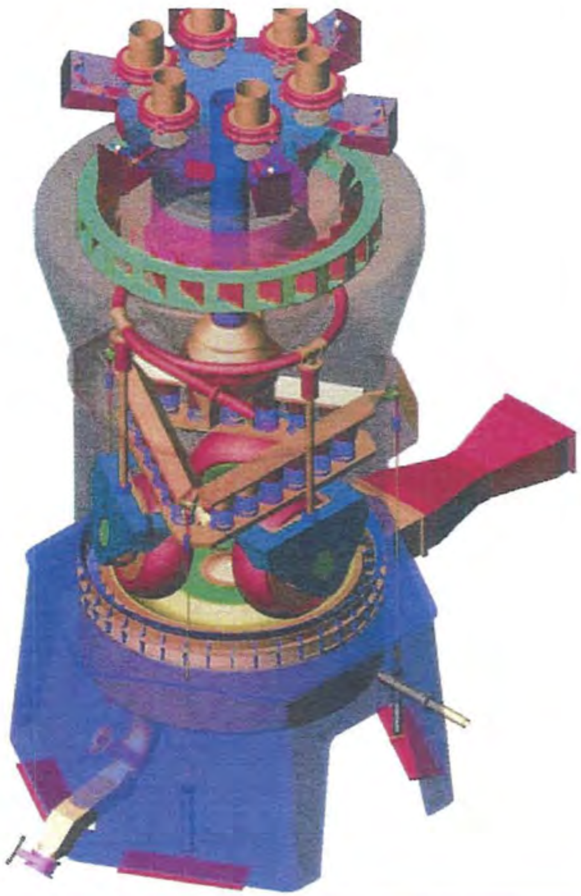
B&W CCW throat port size	X Large	X Large	Large	Large	Large	Large	X Large	X Large
Date Tested	8/15/2007	8/15/2007	8/16/2007	8/16/2007	8/16/2007	8/16/2007	8/16/2007	8/16/2007
Unit	2	2	2	2	2	2	2	2
Mill	2/A	2/A	2/B	2/B	2/C	2/C	2/D	2/D
% Feeder Speed	70	85	70	90	70	90	70	70
Test Period Average Data								
Test	11	12	13	14	15	16	17	18
Unit Pulv	2/A	2/A	2/B	2/B	2/C	2/C	2/D	2/D
% Feeder Speed	70.69	85.74	70.33	90.20	71.32	87.40	70.37	70.59
Actual Pulv Coal Flow (tph)	48.02	58.29	47.69	61.34	48.43	59.41	47.96	47.96
PA Control Damper Position (%)	80.84	94.77	66.56	74.75	76.01	97.49	69.48	69.59
Hot Air Damper Position (%)	38.55	40.94	38.59	43.35	37.49	41.34	31.55	32.01
Cold Air Damper Position (%)	61.68	58.77	61.77	57.13	62.10	58.81	67.77	68.41
PA Flow (%)	76.65	80.15	71.61	77.01	71.54	74.52	77.49	77.63
PA Inlet Damper Temp (DEGF)	276.19	299.43	272.36	304.29	293.13	319.07	263.32	263.13
Pulv D/P (INWC)	14.32	21.50	9.83	16.12	18.88	26.27	9.74	9.82
Disch Temp (DEGF)	149.68	149.86	150.06	149.99	150.25	150.21	150.23	150.29
Pulv Motor (amps)	60.61	65.12	69.33	72.45	57.64	63.75	72.15	72.07
Burner Line Velocity (ft/min)	4323	4609	3974	4343	4070	4319	4298	4304
PA Mass Flow (kpph)	229.872	240.609	214.755	231.093	214.695	223.630	232.562	232.802
Pulv hrs since 30K Overhaul	5399	5399	9999	10000	401	402	12666	12667
Pulv amp swing	6.60	7.35	9.10	10.08	4.77	7.20	10.86	10.15
PA Duct Pressure (INWC)	51.74	52.00	52.94	52.95	52.89	53.35	53.67	53.95
Skid Press Set Point	off	off	2154	2393	2180	2400	2161	2161
Skid Press Feedback	10	9	2151	2285	2357	2358	2267	2270
Coal Bias	0.0	0.0	0.0	0.0	0.00	0.00	0.0	0.0
Air Bias	5.0	5.0	0.0	0.0	0.00	0.00	6.0	6.0
Atmospheric Pressure (IN HG)	25.48	25.47	25.48	25.48	25.49	25.49	25.48	25.48
Ambient Temperature (Deg F)	94.48	95.92	76.45	80.75	85.64	87.62	93.85	95.81
	Locked	Locked	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI	2400 PSI

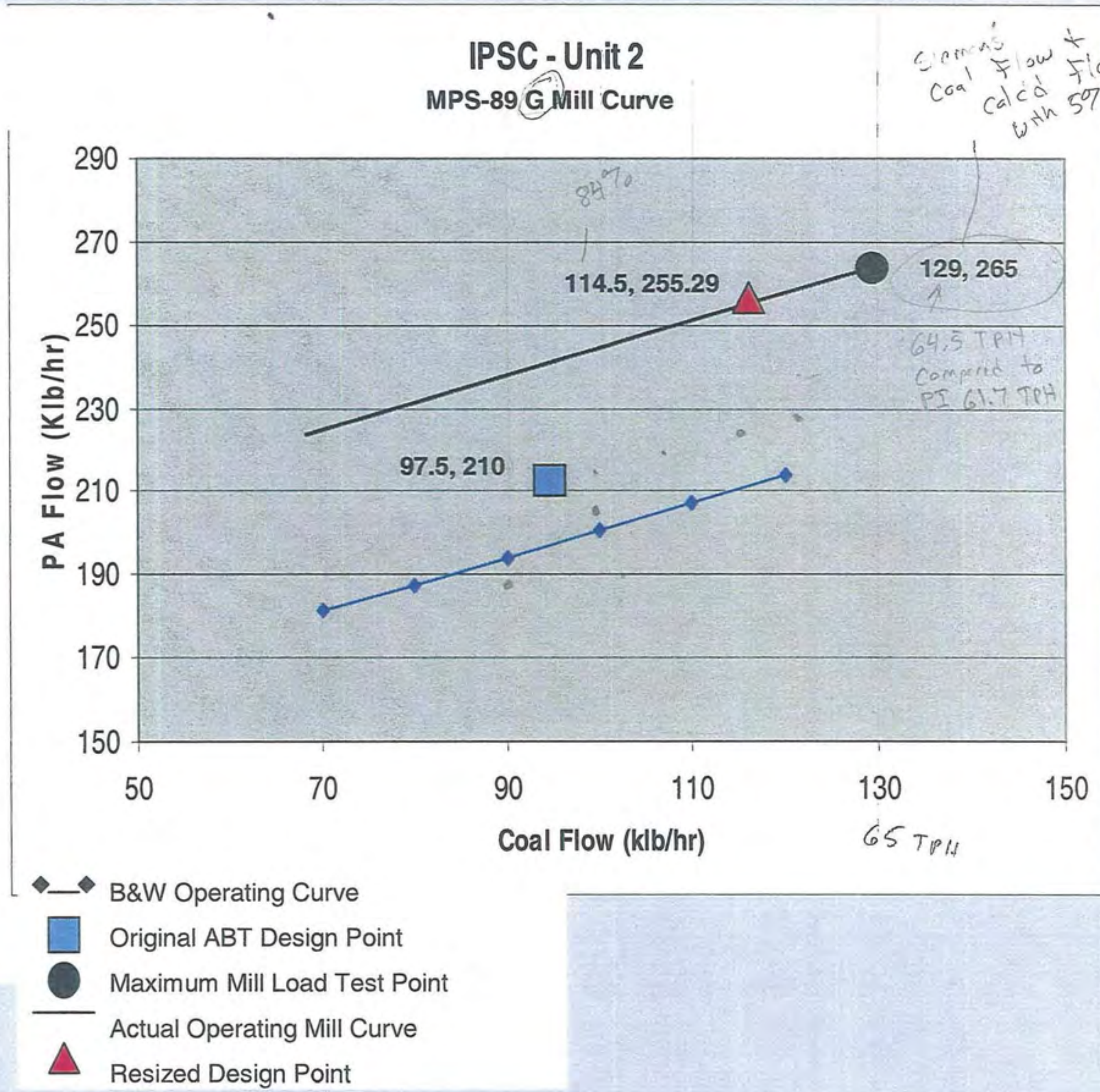
Intermountain Power Service Corp
ABT Siemens Warranty Claim

SIEMENS

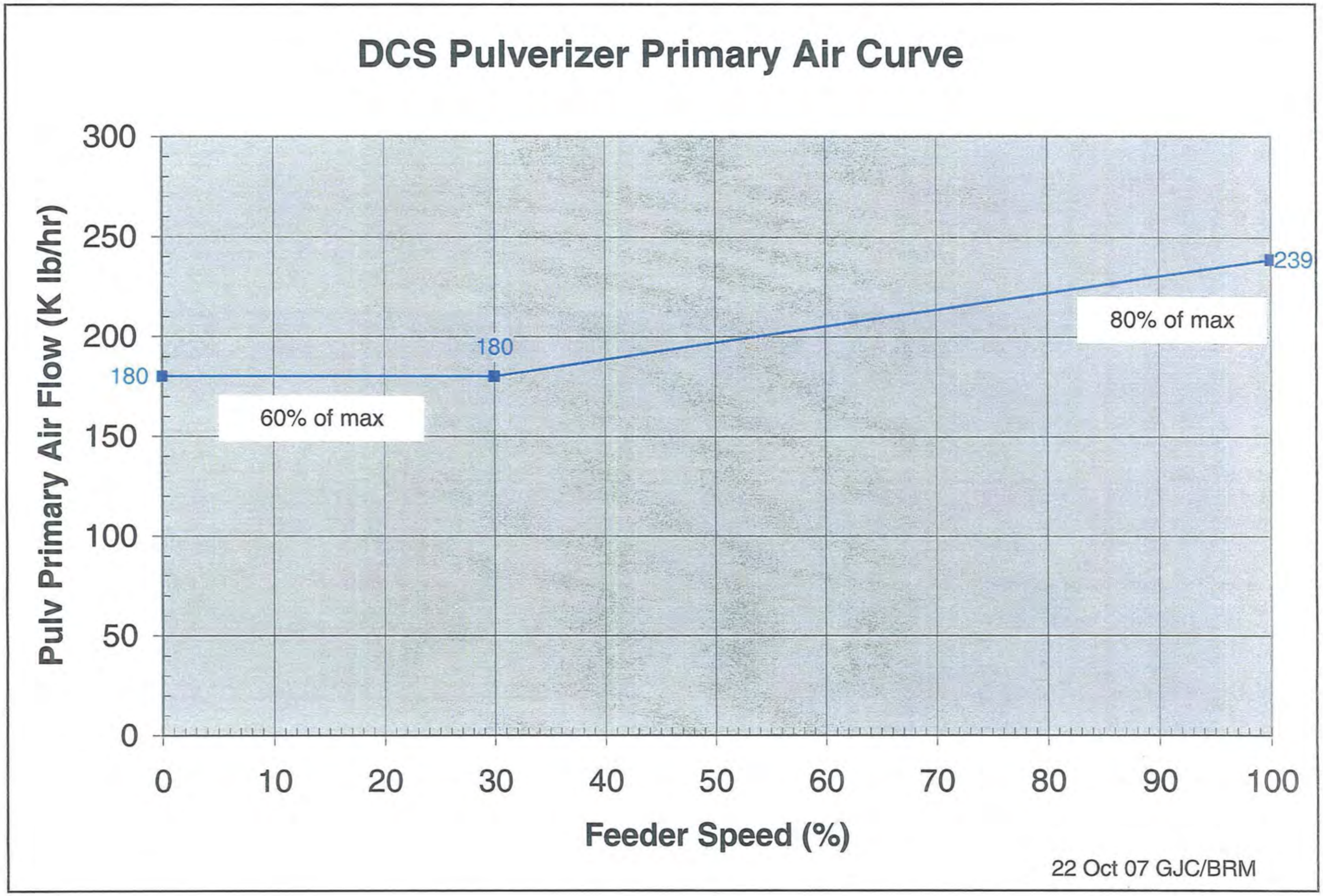
G mill

Erosion and Mill Air Flow





IP7021717


DCS Pulverizer Primary Air Curve
Pulv Primary Air Flow (K lb/hr)
300
250
200
150
100
50
0
180
180
239
60% of max
80% of max
0
10
20
30
40
50
60
70
80
90
100
Feeder Speed (%)
22 Oct 07 GJC/BRM

Conference Call 10-17-07

~~primary~~ contributary cause erosion, secondary thinner wall thickness

weld between nozzle & tip

without stress nozzle would not ~~stress~~ crack
all cracks propagate toward tip

material 85-90 ~~ft~~ per sec
+ 15% double wear rate

25.1 barometric

255, (265)
PA

Can we see a model of flat back
& view point

IF view point is only reason going to flat back.

Siemens
Rob Allen
unable Tom Cochran

IPSC
George Cross
Dennis Killian
Jerry Hintze
Garry Christensen

From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: "Cochran, Thomas A O64" <thomas.cochran@siemens.com>, <Garry-C@ipsc.com>
Date: 10/17/2007
Time: 2:00 PM - 3:00 PM
Subject: IPSC Conference Call
Place: Telecon
Attachments: meeting.ics

When: Wednesday, October 17, 2007 4:00 PM-5:00 PM (GMT-05:00) Eastern Time (US & Canada).
Where: Telecon

~~*~*~*~*~*~*~*~*

Garry,

Please forward this to George Cross.

The call is scheduled for 2:00 PM Mountain time, 4:00 PM Eastern time.
I will forward the power presentation in a separate email.

Bob Allen

The call in numbers are

Toll free number: 1-877-429-3907
Toll number: +1-517-876-7182
Participant passcode: 4799633

From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 10/17/2007 12:20 PM
Subject: RE: Power Point

Garry,

I am having some technical problems.
The email with the PowerPoint presentation came back as undeliverable.
I am having our IT people check out why.
This is call is intended to show you what we have done technically.
Tom Cochran would like to have a meeting at the plant with George Cross to discuss the commercial aspects on October 31. If that date is not possible, his next open day is November 5th. Can you check these dates out and we can confirm one of these dates in this afternoon's meeting.

Bob Allen

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Wednesday, October 17, 2007 9:20 AM
To: Allen, Robert J O642
Subject: Power Point

Bob, I have not received the power point presentation yet. Have you sent it? We would like to review it before the meeting if possible.
Thanks

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

Pulv Primary Air (lbs/hr) Test Flows (lb/hr)

Pulv	A	B	C	D	E	F	G	H	
PI	240,896	231,414		231,549	231,347	246,592	246,189	231,426	
Siemens cal'd	285,864	285,090		284,954	289,679	297,451	300,841	287,260	
1.33% by IPSC probe coeff 0.970									
w/probe coeff 0.928	273,865	272,746		272,616	277,136	284,572	287,814	274,822	
moisture evap	4,584	5,586		5,941	6,060	5,592	6,762	5,404	
seal air	15,874	15,874		15,874	15,874	15,874	15,874	15,874	
calc'c PA	253,407	251,286		250,801	255,202	263,106	265,178	253,544	
	-5.19	-8.59		-8.31	-10.31	-6.70	-7.71	-9.56	
PI	240,655	231,093	223,630	232,682	230,445	231,180	245,229	230,834	
Air Monitor	243,946	243,554	231,590	239,639	243,405	243,396	258,191	243,815	
traverse	-1.35%	-5.12	-3.44	-2.9	-5.32	-5.02	-5.02	-5.32	DCS vs traverse

% deviation

	A	B	C	D	E	F	G	H
Siemens vs Air Monitor at same conditions	3.878	3.175			4.847		2.706	3.990

Siemens 3.72% higher than Air Monitor

C:\GC\Siemens\Air Monitor vs Siemens PA flows.xls

IP7021722

Mill	Feeder Speed%	Traverse Flow LBS/HR.	Flow Element Flow LBS/HR.	DCS Flow LBS/HR.	Flow Element VS. Traverse Error%	[redacted]
A	70	234,822	219,616	229,872	-6.48	
A	85	243,946	230,206	240,655	-5.63	
B	70	227,537	210,529	214,755	-7.47	
B	90	243,554	225,305	231,093	-7.49	
C	70	223,714	207,535	214,695	-7.23	
C	90	231,590	214,671	223,630	-7.31	
D	70	239,019	223,336	232,562	-6.56	
D	70	240,258	223,885	232,802	-6.81	
E	55	215,316	199,804	202,460	-7.20	
E	70	226,653	210,673	215,352	-7.05	
E	90	243,405	225,855	230,445	-7.21	
F	55	212,976	195,612	202,080	-8.15	
F	70	225,157	207,716	214,640	-7.75	
F	90	243,396	223,831	231,180	-8.04	
G	70	241,615	225,035	229,900	-6.86	
G	90	258,191	240,614	245,229	-6.81	
H	70	226,387	209,902	214,822	-7.28	
H	90	243,815	226,085	230,834	-7.27	

$\frac{(DCS - traverse)}{DCS} 100$

Preliminary Results of Primary Air Traverse Testing On Unit 2 by Air Monitor August 14-16, 2007

The preliminary results of the testing showed that the DCS flow values were reading 4.38% lower than the manual traverse values over all the testing. Air Monitors plan is to get their probe and box calibration checked in a wind tunnel and then provide recommendations. They stated that manual traverse test accuracy is +/- 7.5% and their flow element is +/- 3%. The average of the tests on each pulverizer's DCS value compared to the traverse value is as follows:

A Pulv	-1.73%	(DCS value lower than traverse value)
B Pulv	-5.37%	
C Pulv	-3.73%	
D Pulv	-2.90%	
E Pulv	-5.43%	
F Pulv	-4.94%	
G Pulv	-4.94%	
H Pulv	-5.22%	

Since all traverse testing values were higher than the values to the DCS , Air Monitor recommended to wait until the calibration on their probe was checked before giving any final recommendations.

Below is the flow values (lbs/hr) measured on the upper test ran on each pulverizer:

	Traverse Flow	DCS Flow
A Pulv 85% fdr speed, 5% air bias	243,946	240,655
B Pulv 90% fdr speed	243,554	231,093
C Pulv 90% fdr speed	231,590	223,630
D Pulv 70% fdr speed, 6% air bias	239,639	232,682
E Pulv 90% fdr speed	243,405	230,445
F Pulv 90% fdr speed	243,396	231,180
G Pulv 90% fdr speed, 5% air bias	258,191	245,229
H Pulv 90% fdr speed	243,815	230,834

ADVANCED BURNER TECHNOLOGIES

271 Route 202/206
P.O. Box 410
Pluckemin, NJ 07978
P 908.470.0470
F 908.470.0479
www.advancedburner.com

Mr. Garry Christensen, PE
Performance Engineer
Intermountain Power Service Corporation
850 West Brush Wellman Road
Delta, Utah 84624-9546

April 10, 2006

Re: Intermountain Delta #1
Burners

Dear Garry:

Advanced Burner Technologies Corp has evaluated the photographs and information provided depicting the damage to the burners on Delta #1. It appears that all the damage is cracking on the upstream side of the coal nozzles, next to the carbon steel fuel barrel.

Last fall we were notified that the furnace end of the fuel barrel, upstream of the stainless steel nozzle, was being overheated and that this problem had occurred with the OEM burners that were replaced. IPSC had modified the OEM fuel barrels by adding a stainless steel section upstream of the nozzle. However, this information had never been provided to ABT, as discussed at our meeting last fall when Joel Vatsky and Sal Ferrara visited the station.

We believe the cause of the nozzle cracking is the overheating of the fuel barrel that causes excessive stress on the weld between the carbon steel barrel and tip casting. ABT has converted both B&W and Foster Wheeler boilers to this type of burner and we have never had a single nozzle failure; nor failure of any throat casting.

We have recently tested the burners on a 530MW, 24 burner, Foster Wheeler unit, that has been in service with essentially the same burner as at Delta #1. This unit has burner throats only slightly smaller than those at Delta #1: 49" vs 51" respectively. Since the FW burners had originally been equipped with thermocouples, we retained them on the ABT burners. A test has been run where we gradually closed the register sleeve dampers to fully closed while the burner barrel and tip temperatures were measured.

The result was that the tip temperatures remained well within the temperature limitation for the casting. However, the carbon steel barrel temperatures rose to over 900°F and would have caused the same damage seen at Delta if the sleeve damper was not opened slightly. This unit has been in service nearly two years and was recently inspected during an outage. The burner barrels and nozzles, as well as the throat rings, were in "like-new" condition.

The difference in control philosophy between FW and B&W means that on the former unit the sleeve dampers are remotely operated to control flow into the individual burners, whereas the

IP7021725

latter unit's sleeve dampers are manually controlled, with flow controlled by the compartmented windbox control dampers.

If those windbox dampers are not sufficiently opened, furnace gases will come too close to the burner parts and cause the type of damage seen on the Delta #1 burners.

ABT believes that insufficient secondary air flow when the burners are out of service is the cause of this damage. The fact that IPSC resolved the barrel overheating problem by replacing a section of carbon steel barrel with stainless steel, in the section that ABT measured with high temperatures when the air flow is insufficient, confirms our analysis.

We have already requested information from IPSC to evaluate the windbox dampers' controls and actuators to see if the dampers remain sufficiently open when the burners are out of service. After this information is received, we would like to discuss this matter further with you.

Very truly yours,

Tom Shults

Tom Shults, PE
Project Manager
Advanced Burner Technologies

C: Dean Wood, Joel Vatsky, Tarkel Larson, Sal Ferrara

10-15-07

Issues with burner tips at Intermountain

It should be noted that destruction of the burners occurred in less than two years since initial installation of the burners.

We feel that several failure mechanisms are occurring and not just one. We feel that they are:

1. Overheating of the tip in an out-of-service condition causing cracking in the tip due to tip design constraints. In the contract it was stated that "*There are no environmental limitations to the coal burners. The reason for stating that there are no environmental limitations to the coal burners is that the stainless steel castings and plate facing the fire, ASTM 297 Gr He or 309 will not deteriorate at temperatures of at least 2,000 F. Consequently, ABT does not consider operation of its design in your boiler to have any environmental limitations. The conditions are such that no material will operate anywhere near its limit. In fact, ABT has placed no such limitation on any retrofit ABT has done.*
   Thermocouples were initially installed to monitor the tip and barrel temperatures. Out of service temperatures show that many burner tip temperatures did not even reach the 1600 F limit of the indications even though these burners experienced the same destruction. Cracking near the end of the tip do not appear to be connected to the cracking at the erosion areas.

2. Overheat and permanent deformation of the burner barrel causing excessive stress on the weld between the carbon steel barrel and tip casting. Barrel temperatures during an out-of service condition ranged from 700 to 1000 F. Typically each of the six burners on a row had different upper temperatures.

3. Material loss at the flower tip. The contractual proposal stated that "*The segmented coal nozzle has an open design with no obstructions to wear or to collect coal and all wear is limited to the wear-resistant devices in the elbow.*" In less than two years, significant material loss at the flower tip ridges occurred. Cracking from these thinned areas has also occurred. Ductile materials can be very sensitive to abrasion-causing particles depending on the angle of impact. The angle of the tip ridges is around 18 degrees which is high on the erosion vs impact chart.

However you made an error, this is the correct method for calculating mass air flow,

We agree with the interpretation of the B&W curve:

Primary Air Flow = 66,500 ft^3/min@150 f°

The difference comes in the conversion to mass flow, B&W curves are based on mill outlet conditions and150 f° instead of standard conditions. Therefore, the conversion to mass flow should be done at mill operating pressure which is 29.92 in/Hg absolute (25.21 atmospheric + 4.71 mill pressure). ⇒ 4.71"Hg * 13.6 "Wc/"Hg = 64.06 "WC

Say 25" wc ⇒

Density of air @mill outlet = P/RT

Where:

P = Pressure

R = Gas Constant

T = Temperature, R°

1"Hg = 70.72619 lb/ft²

1954.624

= (2116 lbsf/ft^2)/(53.4ft-lbf/lbm-R°)(150 + 460) R°

= 0.065 lbm/ft^3

Specific Volume = 15.38 ft^3/lbm

Mass Flow = $\frac{(66{,}500\ ft^3/min)(60\ min/hr)}{15.38\ ft^3/lbm}$ = 259,428 lbsm/hr

239,422

Pre-Installation Testing

We could find nothing in the contract that requires IPSC to perform pre installation testing or balancing. We found one sentence in your proposal, Section 2.2, that said: *"This primary air flow must be verified during pre retrofit testing."* It did not indicate who was responsible for performing the testing.

We do not remember any request from ABT for testing to verify primary air flow. If this was important and it was not being supplied, you had a responsibility to let us know in writing (Agreement, Part D, Division B1).

Overheating of the Nozzle

We still do not understand what you think we know about nozzle overheating that we have not or did not tell you. The first set of B&W nozzles failed after 5-10 years of service from overheating. The nozzles failed at the welded axial seam and the nozzles drooped because the carbon steel sections failed at the transition. This was corrected by purchasing cast nozzles, thus eliminating the seam, and by extending the alloy tip further back into the burner barrel. The nozzles you provided are also cast so there was nothing more to tell you about that. The location of your transition from carbon to alloy steel is nearly in the same location in relation to the furnace wall as the existing longer nozzles so nothing in our experience would suggest changing it.

THIELSCH ENGINEERING

195 Frances Avenue
Cranston, RI 02910-2211

Invoice Number 070206
Invoice Date January 21, 2008
PO Number 08-62123

Project PED-60-07-0068
Page 1 of 2
Terms NET 30

Gary Christensen
INTERMOUNTAIN PWER SERV CORP
850 WEST BRUSH WELLMAN ROAD
DELTA, UT 84624-9546

For consulting engineering & laboratory services involving the following:

Metallurgical evaluation of Coal Burner Tip subject to embrittlement and erosion which was removed from the No. 2 Boiler at the Intermountain Power facility in Delta, Utah. Costs also include preparation of Thielsch Engineering report No. 12453 covering our examination of the failed coal burner tip.

Two copies and a CD containing an Adobe Acrobat (.pdf) file of the report were mailed to Mr. Gary Christensen on January 4, 2008.

PROFESSIONAL SERVICES

		W/E	Hours	Rate	Amount
Engineering Analysis	JULIE A. BROWN	10/7/07	0.25	150.00	37.50
Engineering Analysis	JULIE A. BROWN	11/4/07	0.50	150.00	75.00
Level II NDE Tech	FRANCIS THEROUX	10/7/07	2.00	60.00	120.00
Metallographer	THOMAS DICARLO	10/7/07	1.00	110.00	110.00
Metallographer	THOMAS DICARLO	10/28/07	12.75	110.00	1,402.50
Metallographer	THOMAS DICARLO	11/11/07	2.00	110.00	220.00
Metallographer	THOMAS DICARLO	11/18/07	2.00	110.00	220.00
Photography	THOMAS DICARLO	10/21/07	4.50	110.00	495.00
Photography	THOMAS DICARLO	10/28/07	3.00	110.00	330.00
Report Assembly	HACKETT, KATHERINE	12/23/07	5.50	45.00	247.50
Report Assembly	HACKETT, KATHERINE	1/6/08	1.50	45.00	67.50
Report Assembly	PHYLLIS GOBLE	12/16/07	4.50	45.00	202.50
Report Assembly	PHYLLIS GOBLE	12/30/07	1.00	45.00	45.00
Engineering Svcs	NALBANDIAN, ARA	9/30/07	2.00	175.00	350.00
Engineering Svcs	NALBANDIAN, ARA	11/11/07	1.00	175.00	175.00
Report Review	NALBANDIAN, ARA	12/16/07	1.50	175.00	262.50
Engineering Svcs	VAROUJAN KALIKIAN	11/18/07	6.00	140.00	840.00
Report Writing	VAROUJAN KALIKIAN	10/28/07	8.00	140.00	1,120.00
Report Writing	VAROUJAN KALIKIAN	11/25/07	7.00	140.00	980.00
Report Writing	VAROUJAN KALIKIAN	12/9/07	23.00	140.00	3,220.00
Engineer Analysis	VAROUJAN KALIKIAN	10/21/07	4.00	140.00	560.00
PROFESSIONAL SERVICES			93.00		11,080.00

IP7021729

INTERMOUNTAIN PWER SERV C

Invoice Number 070206
Project PED-60-07-0068
Page 2 of 2

REIMBURSABLE EXPENSES

Subcontractors LABORATORY TESTING INV# 0238171-IN	48.30
Invoice Total	11,128.30

Billing inquiries to: ESTEBAN GOMEZ

GOODS OR SERVICE ACCEPTED BY:

G. Christensen

APPROVED FOR PAYMENT

AUTHORIZED SIGNATURE DATE

W. Bloomfield

RECEIVED
JAN 28 2008
IPSC ACCOUNTING

VENDOR # 2954 REMIT TO # 7
VOUCHER # 08080219 19/S
AMT PAID $ 11,128.30
CHECK NO ______ DUE DATE 1/31/08
Advise PO #15,000 OB
2SGX-402

REMIT TO: THIELSCH ENGINEERING, INC. P.O BOX 845327 BOSTON, MA 02284-5327
Tel.. (401) 467-6454 * Fax: (401) 467-2398
Federal ID #050405629

1995 Annual Book of ASTM Standards
~~Steel~~ Ferrous Castings; Ferroalloys
Volume 01.02

TABLE 1 Chemical Requirements

Grade	Type	Composition, %							
		Carbon	Manganese, max	Silicon, max	Phosphorus, max	Sulfur, max	Chromium	Nickel	Molybdenum, max[A]
HF	19 Chromium, 9 Nickel	0.20–0.40	2.00	2.00	0.04	0.04	18.0–23.0	8.0–12.0	0.50
HH	25 Chromium, 12 Nickel	0.20–0.50	2.00	2.00	0.04	0.04	24.0–28.0	11.0–14.0	0.50
HI	28 Chromium, 15 Nickel	0.20–0.50	2.00	2.00	0.04	0.04	26.0–30.0	14.0–18.0	0.50
HK	25 Chromium, 20 Nickel	0.20–0.60	2.00	2.00	0.04	0.04	24.0–28.0	18.0–22.0	0.50
HE	29 Chromium, 9 Nickel	0.20–0.50	2.00	2.00	0.04	0.04	26.0–30.0	8.0–11.0	0.50
HT	15 Chromium, 35 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	15.0–19.0	33.0–37.0	0.50
HU	19 Chromium, 39 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	17.0–21.0	37.0–41.0	0.50
HW	12 Chromium, 60 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	10.0–14.0	58.0–62.0	0.50
HX	17 Chromium, 66 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	15.0–19.0	64.0–68.0	0.50
HC	28 Chromium	0.50 max	1.00	2.00	0.04	0.04	26.0–30.0	4.00 max	0.50
HD	28 Chromium, 5 Nickel	0.50 max	1.50	2.00	0.04	0.04	26.0–30.0	4.0–7.0	0.50
HL	29 Chromium, 20 Nickel	0.20–0.60	2.00	2.00	0.04	0.04	28.0–32.0	18.0–22.0	0.50
HN	20 Chromium, 25 Nickel	0.20–0.50	2.00	2.00	0.04	0.04	19.0–23.0	23.0–27.0	0.50
HP	26 Chromium, 35 Nickel	0.35–0.75	2.00	2.50	0.04	0.04	24–28	33–37	0.50

[A] Castings having a specified molybdenum range agreed upon by the manufacturer and the purchaser may also be furnished under these specifications.

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements shall not apply unless specified in the purchase order. A list of standardized supplementary requirements for use at the option of the purchaser is included in Specification A 781/A 781M. Those which are ordinarily considered suitable for use with this specification are given below. Others enumerated in A 781/A 781M may be used with this specification upon agreement between the manufacturer and purchaser.

S1. Magnetic Particle Examination

S2. Radiographic Examination

S3. Liquid Penetrant Examination

S4. Ultrasonic Examination

S5. Examination of Weld Preparation

S6. Certification

TABLE 2 Tensile Requirements

Grade	Type	Tensile Strength, min		Yield Point, min		Elongation in 2 in. [50 mm], min, %[A]
		ksi	[MPa]	ksi	[MPa]	
HF	19 Chromium, 9 Nickel	70	485	35	240	25
HH	25 Chromium, 12 Nickel	75	515	35	240	10
HI	28 Chromium, 15 Nickel	70	485	35	240	10
HK	25 Chromium, 20 Nickel	65	450	35	240	10
HE	29 Chromium, 9 Nickel	85	585	40	275	9
HT	15 Chromium, 35 Nickel	65	450	. . .	. . .	4
HU	19 Chromium, 39 Nickel	65	450	. . .	. . .	4
HW	12 Chromium, 60 Nickel	60	415	. . .	. . .	. . .
HX	17 Chromium, 66 Nickel	60	415	. . .	. . .	. . .
HC	28 Chromium	55	380	. . .	. . .	. . .
HD	28 Chromium, 5 Nickel	75	515	35	240	8
HL	29 Chromium, 20 Nickel	65	450	35	240	10
HN	20 Chromium, 25 Nickel	63	435	. . .	. . .	8
HP	26 Chromium, 35 Nickel	62.5	430	34	235	4.5

[A] When ICI test bars are used in tensile testing as provided for in this specification, the gage length to reduced section diameter ratio shall be 4 to 1.

S7. Prior Approval of Major Weld Repairs

S8. Marking

S9. Tension Test

S9.1 One tension test shall be made from material representing each heat. The bar from which the test specimen is taken shall be heat treated in production furnaces to the same procedure as the castings it represents. The results shall conform to the requirements specified in Table 2.

S9.2 Test bars shall be poured in separately cast keel blocks similar to Fig. 3 of Test Methods and Definitions A 370 or Fig. 1 of Specification A 447/A 447M.

S9.3 Tension test specimens may be cut from heat-treated castings; or from as-cast castings if no heat treatment is specified for the castings, instead of from test bars when agreed upon between the manufacturer and the purchaser.

S9.4 Test specimens shall be machined to the form and dimensions of the standard round 2-in. [50-mm] gage length specimen shown in Fig. 6 of Test Methods and Definitions A 370 and shall be tested in accordance with Test Methods and Definitions A 370.

S9.5 If the results of the mechanical tests for any heat do not conform to the requirements specified, the castings may be re-heat treated and re-tested, but may not be solution treated or re-austenitized more than twice.

S9.6 If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted from the same heat.

From: Nancy Bennett
To: Garry Christensen
CC: Kathy Barnes
Date: 10/10/2007 1:00 PM
Subject: Thielsch Engineering

Hi Garry,

I'm checking to see if you have received the analysis on the burner tips. It is purchase order no. 08-62123. If this is complete, would you please let Kathy Barnes know so it can be received in the system?

Thanks,
Nancy

From: "Ara Nalbandian" <nalbandiana@thielsch.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
CC: "Roger A. Kalikian" <RKalikian@thielsch.com>
Date: 10/13/2007 12:34 PM
Subject: RE: Failure analysis on burner tips

Garry,

I will certainly appreciate if you can share with us any information or reports which relate to the failure of the burner tips. Our preliminary examinations of the material show cracking of the welds and preferential wear of the metal. Our testing program is continuing. Please let me know your thoughts. Thanks

Regards,

Ara

Ara Nalbandian, P.E.

Vice President, Engineering

Thielsch Engineering

195 Frances Ave.

Cranston, RI 02910

401- 467-6454

401-467-2398 fax

www.thielsch.com

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Tuesday, October 09, 2007 10:21 AM
To: Ara Nalbandian
Subject: RE: Failure analysis on burner tips

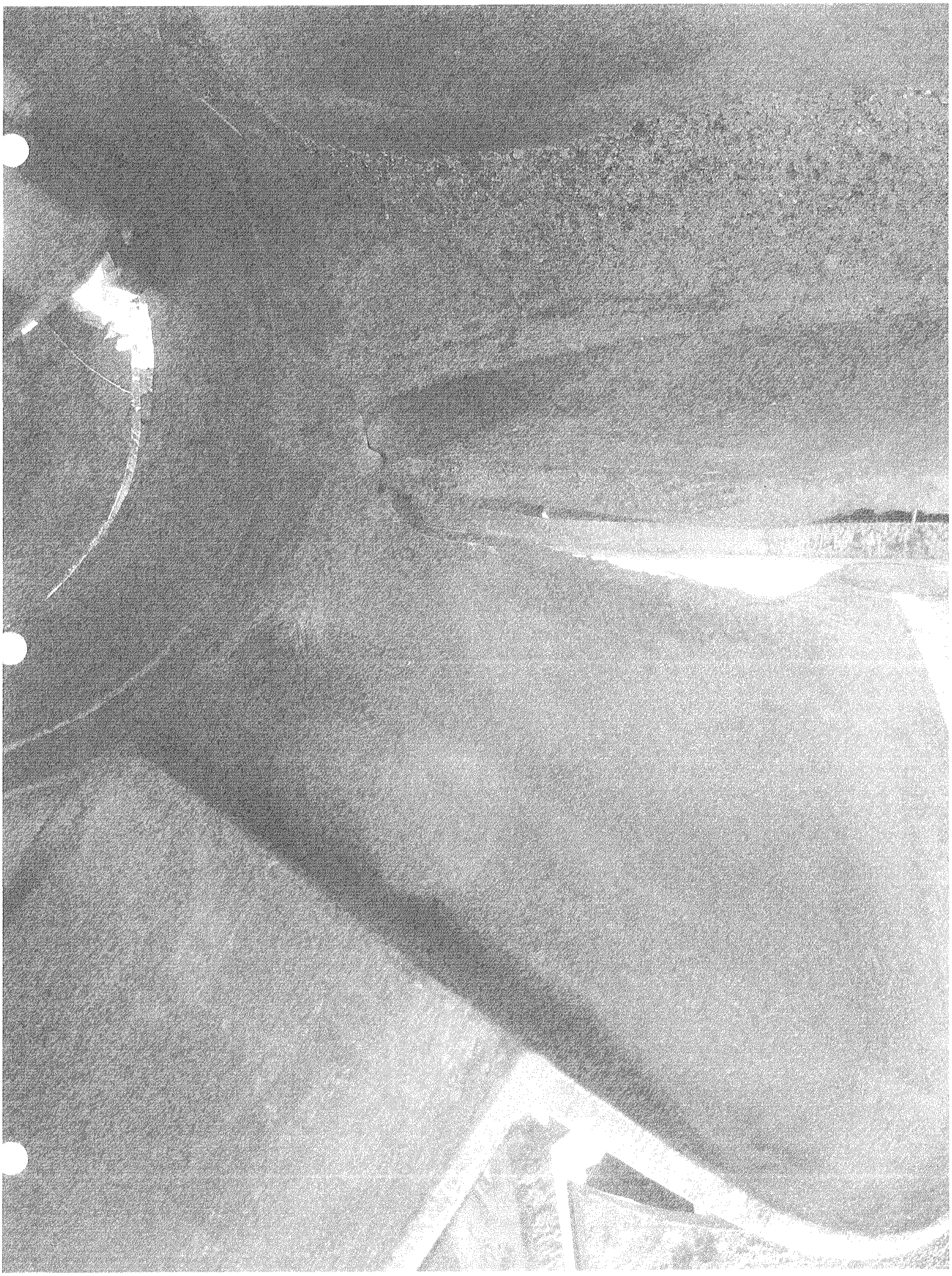
Ara, just checking to see if you have all the information that you need. I hope the work is progressing. We do have our opinion on issues with the burner tip and can share them if requested.
Regards

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

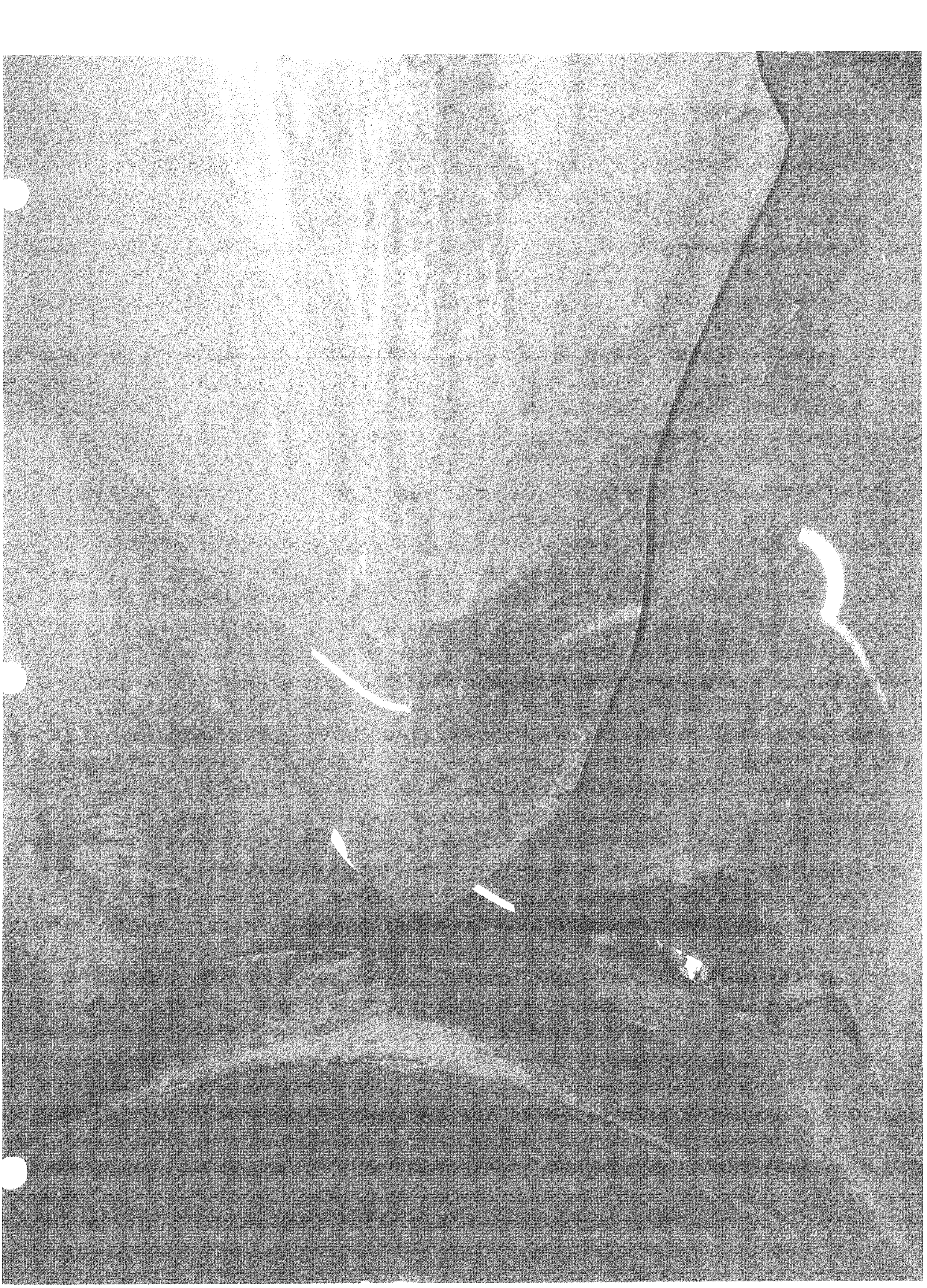
UC 116 MD1 1/P Taken 1-18-01 To be shipped To Thielsch Engineering

IP7021735

IP7021736



IP7021737



IP7021738

MEMORANDUM

INTERMOUNTAIN POWER SERVICE COR

TO: George W. Cross

Garry Christensen

Page 1 of 1

FROM: Dennis K. Killian

DATE: September 13, 2007

SUBJECT: Manual Requisition Approval for Failure Analysis on Burner Tip

Please approve the attached manual requisition for a failure analysis to be performed by Thielsch Engineering on an Advanced Burner Technology (ABT) burner tip.

In the August 1, 2007 meeting at IPSC, Robert Allen from Siemens stated that from their analysis, the primary failure mechanism was erosion/thinning and then cracking propagated from the thinned areas. Technical Services personnel have also seen cracking not attached to any erosion areas and feel that an independent failure analysis on a failed ABT tip would be beneficial. This evaluation is not for contention purposes but to help verify and cover any other failure mechanisms so the new design will be successful.

The analysis work will be charged to work order 06-03474 Capital Project IGS07-2.

Any questions regarding this request may be directed to Garry Christensen at extension 6486.

GC/DEW:jmj
Attachment

IP7021739

MEMORANDUM

INTERMOUNTAIN POWER SERVICE CORPORATION

TO: George W. Cross

FROM: Dennis K. Killian

DATE: September 12, 2007

SUBJECT: Approval on manual requisition for failure analysis on burner tip.

Please approve the attached manual requisition for a failure analysis to be performed by Thielsch Engineering on an ABT burner tip. Robert Allen from Siemens in the August 1, 2007 meeting at IPSC stated that from their analysis the primary failure mechanism was erosion/thinning and then cracking propagated from the thinned areas. Technical Services have also seen cracking not attached to any erosion areas and feel that an independent failure analysis on a failed Advanced Burner Technology tip would be beneficial. This evaluation is not for contention purposes but to help verify and cover any other failure mechanisms so the new design will be successful.

The analysis work will be charged to work order 06-03474 Capital Project IGS07-2.

Any questions regarding this request may be directed to Garry Christensen at extension 6486.

INTERMOUNTAIN POWER SERVICE CORPORATION

☐ REQUISITION FOR CAPITAL EQUIPMENT

☒ PURCHASE AUTHORIZATION FOR EXPENSE ITEMS

Purpose of Materials, Supplies or Services:

Perform a failure analysis and determine the failure mechanism on a ABT Burner Tip

Date: 12-Sep-07	
Req./PA No: 234385	
P.O. No: 08-62123	
Vendor:	
Terms:	
FOB:	
Ship Via:	
Conf. To:	

Suggested Vendor: Thielsch Engineering
195 Frances Ave.
Cranston, RI 02910

Account No. 00-2SGX-402
Work Order No. 06-03474
Project No. IGS07-02

Qty	Unit	Noun / Description Adjective / Catalog # / Seller or Manufacturer	Unit Cost	Extension
1	ea	Failure Analysis on ABT burner tip	$15,000.00	$15,000.00
		TOTAL ESTIMATED COST		$15,000.00

Remarks: ______

Delivery requested by [Date] 09-30-07 Originator Garry Christensen

Dept. Mgr/Supt. Date Station Manager Date Operating Agent Date

IP7021741

From: "Ara Nalbandian" <nalbandiana@thielsch.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 9/12/2007 8:25 AM
Subject: RE: Failure analysis on burner tips

CC: "Roger A. Kalikian" <RKalikian@thielsch.com>, "Charlene K Rigali" <CRiga...

Good Morning Garry,

Thank you for the pictures and the drawing. The picture show that the burner tip material is broken apart. As we discussed before we can perform the failure analysis and determine the failure mechanism. Generally, such project are investigative in nature and would require laboratory examinations which would include fractography, Scanning Electron Microscopy/Energy Dispersive X-Ray Spectroscopy, mechanical testing and metallurgical evaluation. Since such project are performed on time and material basis it is rather difficult to provide you affirm quotation, we would recommend an estimated budgetary amount of $10000.00 to $15000.00 to perform the failure analysis. Pleas call me if you have any question.

Regards,

Ara

Ara Nalbandian, P.E.

Manual Req # 234385

Vice President, Engineering

Thielsch Engineering

195 Frances Ave.

Cranston, RI 02910

401- 467-6454

401-467-2398 fax

www.thielsch.com

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Friday, August 31, 2007 11:17 AM
To: Ara Nalbandian
Subject: RE: Failure analysis on burner tips

Ara, I have attached several drawings of the ABT burner as well as some pictures. We had all 48 B&W burners replaced with these ABT burners in 2004. In 2006 we had to make extensive repairs to try and last for another two years. We have a opposed fire B&W boiler. Let me know if you need more pictures or information.

Intermountain Power Service Corp.
Performance Engineer

850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

>>> "Ara Nalbandian" <nalbandiana@thielsch.com> 8/31/2007 8:45 AM >>>
Thank you for you interest in Thielsch engineering. We will be pleased to provide you with the necessary technical assistance and laboratory services in performing the failure analysis of the burner tips which have failed. We will also be able to provide you a quotation if we have additional information regarding the failed burner tips. Could you kindly send background information including photographs and or sketches of the failed tips and the respective burner in which they had been used?. I look forward to working with you.

Regards,

Ara

Ara Nalbandian, P.E.

Vice President, Engineering

Thielsch Engineering

195 Frances Ave.

Cranston, RI 02910

401- 467-6454

401-467-2398 fax

www.thielsch.com

From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Friday, August 31, 2007 10:05 AM
To: Ara Nalbandian
Cc: Dean Wood
Subject: Failure analysis on burner tips

Intermountain Power Service Corporation in Delta Utah is interested in getting a cost quote to perform a failure analysis on our Advanced Burner Technology burner tips which have failed in two years. We had Mr. Helmut Thielsch on site to teach a failure analysis class in

December 2001 and put Thielsch Engineering as a possible resource when needed.

Intermountain Power Service Corp.

Performance Engineer

850 W. Brush Wellman Road

Delta, Utah 84624-8546

garry-c@ipsc.com <mailto:garry-c@ipsc.com>

Telephone (435) 864-6486

From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 8/21/2007 9:16 AM
Subject: RE: ABT Burner Sizing

Garry,

Thanks for the quick reply.

I am assuming that 9,225 MMBtu/hr, heat input from combustion, is *straight forward:(lb/hr of coal)*(HHV of the coal). My next question:* Is 9,225 MMBtu/hr, heat input from combustion, a permit limit?

I think that we should wait until normal operation brings the windbox pressure down to zero to take readings. I don't want to force an operating condition just for measurements.

Thanks,
Bob Allen

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Tuesday, August 21, 2007 10:12 AM
To: Allen, Robert J O642
Subject: Re: ABT Burner Sizing

Bob, after talking with our environmental people, they said that the asterisk means "or as determined by the state". He said that the 9,225 MMBtu/hr is heat input from combustion.
Let me know if this doe not answer your question. Also, the pulverizer out this week does not dip down to zero on the windbox pressure. Should I wait for another pulverizer or should I close down on the secondary air dampers until it does and then take readings?

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Performance Engineer
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garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

>>> "Allen, Robert J O642" <robertj.allen@siemens.com> 8/21/2007 7:46 AM
>>>
Garry,
I am trying to determine the maximum heat input to the furnace.
The copy of the air permit page that I got (Page 4, paragraph 8, B) from you stated:

"8. The approved installations shall consist of the following equipment of equivalent*:
B. Unit #2 Coal fired boiler (subject to NSPS, Subpart Da) equipped with Low NOx
burners with maximum heat input of 248 MMBtu/hr per each

burner
Rating - 9,225 MMBtu/hr"

Is 9,225 MMBtu/hr a permit limit on the maximum total heat input to the furnace?
If not, what is the max heat input to the furnace?

I don't have the page that explains the asterisk after the word equivalent.

Thanks,
Bob Allen

Unit 2 Burner Overview Aug 13, 2007

IPSC has been working with Siemens to determine the cause of the ABT burner failures and then come up with a resolution and a fix to be installed during the April 2008 planned outage. On March 22, 2007 Mr. Robert Allen from Siemens traveled to IPSC and information regarding the situation was exchanged. Mr. Allen obtained a sample of a burner nozzle previously removed from service and transported it back to the Siemens Boiler Services offices for a metallurgical analysis. It was stated that Siemens intent is to use Six Sigma methodology to get to the root cause of the failure of the ABT burners and to formulate a resolution and have recommendations/modifications for our burners designed by the end of August 2007. As part of this methodology, both IPSC and ABT agreed that the following are issues:

1. The burner nozzles cracked
2. There is material loss on the following:
    - The nozzle tips
    - The burner barrels
    - The x-vane diffusers
3. Permanent deformation of the burner barrel occurred.
4. There is disagreement between IPSC and ABT as to Primary Air Flow.

On June 21, 2007 Mr. Allen came to review data on questions submitted to IPSC and to determine the sizing for the new burner. A value of 380 tons per hour with a range of 5% was agreed upon. Mr. Allen proposed testing of all Unit 2 pulverizers in the later part of July.

As part of Siemens effort to better understand IPSC claims, pulverizer testing was conducted July 17-21, 2007 on Unit 2 pulverizers. The testing personnel consisted of Dr. Anatoly Sobolevskiy and Tom Riley from Siemens BTS group assisted by Garry Christensen from IPSC.

On August 1, 2007 Mr. Allen traveled to IPSC and discussed preliminary results of the pulverizer testing and preliminary results of the metallurgical testing. It was stated that the material of the tips falls within the specifications and that erosion appears to be the major contributor/primary mechanism. The pulverizer testing showed that their measured airflow was 8-14% higher than the plant recorded air flow. Some of the difference is from the seal air addition. Siemens agreed to send their probe out for calibration. It was also agreed that 269,000 lb/hr should be the designing point for the air flow through the burners and that this value is a reasonable point to represent the actual operating data from their testing.

Air Monitor was contacted by IPSC and is being brought out to traverse test the primary air inlet on Unit 2 pulverizers and to correct any problems found. They feel that their instrumentation is correct and feel that the testing done by Siemens does not account for turbulence and will read high due to the method used. Testing will begin August 14 and continue through the week. Siemens has been contacted and Mr. Allen will be here Tuesday to witness the testing and gather some coal pipe information. Mr. Allen also stated over the phone that the calibration on the test probe showed that at the velocities measured, it was high by over 3%.

Siemens still believes that they are on schedule to provide a resolution and will be able to provide burner replacement parts to the plant site before the start of our Unit 2 outage in April 2008. No indication as to cost or agreement of the burners has been discussed.

Unit 2 Burner Overview Aug 13, 2007

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From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 8/9/2007 12:50 PM
Subject: RE: PA testing on Unit 2

Gary,

We will probably be sending someone to observe. It will not be Anatoly, He is on his way to Europe. I will let you know who as soon as I know. It might be me. Do you have a written test protocol from Air monitor and a scope of supply so that I can brief who ever is going? What time on Tuesday do you think that they will start testing?

Also, have you done anymore investigation on windbox pressure in the off-line burners. This would be a good time to put a manometer on the burner windboxes that are off-line so that we can determine if the pressure is going negative even though the transmitter reads zero.

Thanks,
Bob Allen

CFD is underway right now.

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Wednesday, August 08, 2007 1:14 PM
To: Allen, Robert J O642
Cc: Dean Wood; Dennis Killian; George Cross; Jerry Hintze
Subject: PA testing on Unit 2

Bob, I hope all is going well on the modeling. I am e-mailing you to let you know that as we discussed, we are bringing Air Monitor out to traverse test primary air at the pulverizer inlet. They will begin testing Tuesday morning (Aug 14th) and the plan is to test all of Unit 2 pulverizers. You are welcome to come out or have someone witness the testing if desired. Let me know.

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

From: Jerry Hintze
To: robertj.allen@siemens.com
Date: 8/3/2007 3:05 PM
Subject: 269,000 lbs/hr primary air flow.

CC: Dennis Killian; Garry Christensen; George Cross; Wood, Dean

Dear Mr. Allen,

Based on the testing completed by Siemens and our operating experience, IPSC agrees that a primary air flow rate of 269,000 lbs/hr to the pulverizers is a reasonable point that can be used for modeling the failure of the coal nozzles on Unit 2 at the Intermountain Generating Station.

This agreement is not a statement on the conditions at the time of the failure and may not be used for determination of responsibility of the failure.

Jerry Hintze
Assistant Superintendent
Intermountain Power Service Corporation
850 W. Brushwellman Road
Delta, Utah, 84624

Phone: 435-864-6460
Fax: 435-864-0760
Jerry-H@IPSC.COM

From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 8/2/2007 2:18 PM
Subject: RE: numbers and calcs

Garry,
We agree that 269,000 lb/hr represents the upper limit for primary air flow into the pulverizer for the model. However, we have to agree that the model is representative of the actual maximum operating condition of the pulverizer to proceed forward. My CFD modeler is on hold until we agree. I thought that we all agreed in the staff meeting that was reasonably expected to represent the pulverizer performance that we measured. If this is not the case, I cannot proceed.
Bob Allen

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Thursday, August 02, 2007 2:40 PM
To: Allen, Robert J O642
Subject: RE: numbers and calcs

Bob, we agreed that 269,000 lb/hr should be the upper limit of the model. It falls around the 85 fps velocity we want to stay under. I am just trying to find out why our numbers are off from yours. E pulverizer data was checked by heat balance and so far it appears to be close to your value but the heat balance on the other pulverizers are much closer to the plant data. I am just checking to see if we have a system issue or just a pulverizer issue. We still plan on getting them all tested.

Garry Christensen

Intermountain Power Service Corp.
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>>> "Allen, Robert J O642" <robertj.allen@siemens.com> 8/2/2007 12:01 PM
>>>
Garry,

I have outlined the heat balance calculations that I went over with you yesterday. However, I thought that we had agreed on using the test data from the BTS test, derated 3% to 269,000 lb/hr. If we do not have agreement, I need to schedule a flight back to your plant. I have been told by my boss that if we do not have agreement, I cannot proceed and therefore I will need to meet with the staff again and stay until we have agreement.

Bob Allen

Heat in (the heat in the primary air) = Heat out (heat to evaporate moisture into coal + change in temperature of the coal + change in temperature of the seal air)

BTS Data Heat balance:

Heat to Moisture in Coal

Moisture in coal per IPSC Lab analysis:
Incoming moisture - 6.67%
Leaving Moisture - 1.85%
Moisture loss - 4.85%

Coal flow measured by BTS - 127,692 lb/hr

Moisture evaporated = (Lb/hr coal flow)* (percent water evaporated)
127,692*0.0485 = 6155 lb/hr

BTU required to evaporate 6155 lb/hr of water at an ambient temperature of 90F = (Lb/hr Water)* (Delta enthalpy)
6155*(1127 - 58) = 6,579,695 btu/hr
58 btu/lb is the enthalpy of liquid water at 90 F and 1127 btu/lb is the enthalpy of water vapor at 147.5 F.

Heat to Coal
Btus to heat the coal from 90 F to 147.5
(lb/hr coal flow)* (Cp of coal)*(temp out - temp in)=
127,692 * 0.3 *(147.5-90) = 2,202,687 btu/hr

Heat to Seal Air

Seal air flow - measured at the plant - 15,874 lb/hr
Heat to seal air = (lb/hr air)* (Cp of air)* (Temp out - temp in)=
15,874*0.24*(147.5 - 133)= 55,242 btu/hr

Total Btu required = 6,579,695 + 2,202,687 + 55,242 = 8,837,624 btu/hr

Heat Available

Air in = Air out - seal air - water vapor

Air out measured - 298,147 lb/hr
Seal air flow 15,874 lb/hr
Water Vapor 6155 lb/hr

Total air in = 276,118 lb/hr

Heat in air = (lb/hr air in) * (Cp air) * (Air in temp - Air out temp) =
276,118 lb/hr * 0.24 * (285 - 147.5) = 9,111,864 btu/hr available

Heat available is 3% higher than heat required

IPSC Plant data

Coal flow = 123,420 lb/hr

Heat to Moisture in Coal

Moisture in coal per IPSC Lab analysis:
Incoming moisture - 6.67%
Leaving Moisture - 1.85%
Moisture loss - 4.85%

Coal flow measured by IPSC Plant - 123,290 lb/hr

Moisture evaporated = (Lb/hr coal flow)* (percent water evaporated)
123,420 lb/hr*0.0485 = 5986 lb/hr

BTU required to evaporate 6155 lb/hr of water at an ambient temperature of 90F = (Lb/hr Water)* (Delta enthalpy)
5980*(1127 - 58) = 6,399,034 btu/hr
58 btu/lb is the enthalpy of liquid water at 90 F and 1127 btu/lb is the enthalpy of water vapor at 147.5 F.

Heat to Coal
Btus to heat the coal from 90 F to 147.5
(lb/hr coal flow)* (Cp of coal)*(temp out - temp in)=
123,420 * 0.3 *(147.5-90) = 2,128,995 btu/hr

Heat to Seal Air (the same in both calc,s)

Seal air flow - measured at the plant - 15,874 lb/hr
Heat to seal air = (lb/hr air)* (Cp of air)* (Temp out - temp in)=
15,874*0.24*(147.5 - 133)= 55,242 btu/hr

Total Btu required = 6,399,034+ 2,128,995+ 55,242 = 8,583,271 btu/hr

Heat Available

Air in = 231,290 lb/hr

Heat in air = (lb/hr air in) * (Cp air) * (Air in temp - Air out temp) =
231,290 lb/hr * 0.24 * (285 - 147.5) = 7,632,570 btu/hr available

Heat available is 11% lower than heat required

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Thursday, August 02, 2007 8:37 AM
To: Allen, Robert J O642
Subject: numbers and calcs

Bob, I have gone back trying to match the heat balance around the pulverizer and on E pulverizer (the first one calc'd) I calculated that the air flow needed to balance in vs out would be around 242,000 lb/hr.

I also did the calc on A pulverizer and came closer using our air flow and coal flow as well. I am working today on the other pulverizers. I am just following the heat balance calculations from B&W. Please email me your calcs and numbers so I can see the differences as well as the recovery numbers. I am using the standard probe opening of 3/8" by 13/16" but it must be different because the numbers are not working out. We have a hard time agreeing or even disagreeing when we are not given the whole picture.
Thanks

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Performance Engineer
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To: "Garry Christensen" <Garry-C@ipsc.com>
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garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

Allen, Robert J O642

From: Sobolevskiy, Anatoly O642
Sent: Wednesday, July 25, 2007 7:41 AM
To: Allen, Robert J O642
Cc: Davidson, Michael J O642
Subject: IPSC Testing
Attachments: Air distribution between lines.doc; Coal distribution between lines.doc; A.F Ratio.doc

The preliminary results of the dirty air testing of Unit #2 IPSC:

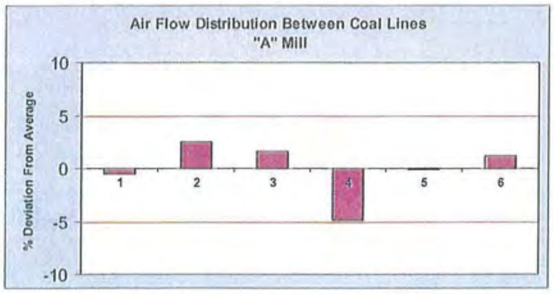
- The coal lines are not balanced with respect to coal flow (at least one or 2 lines in each mill have mass coal flow deviations from the average more than 10%)
- The coal lines are not balanced with respect to air flow (only 3 mills have coal line air flow within +/- 5 % from the average)
- The measured air flow in coal lines is 8-14% higher then the plant recorded air flow.
- Air/fuel ratio in coal lines has significant deviation from mill to mill and within the coal lines for each individual mill (mill averages are in the range 2.0 - 2.7). That is higher then measured by the plant Air/Fuel ratio that is 1.9-2.0.

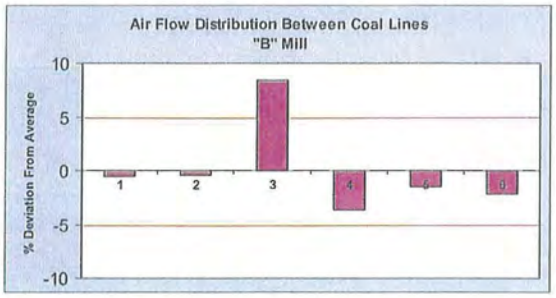
The results are enclosed.

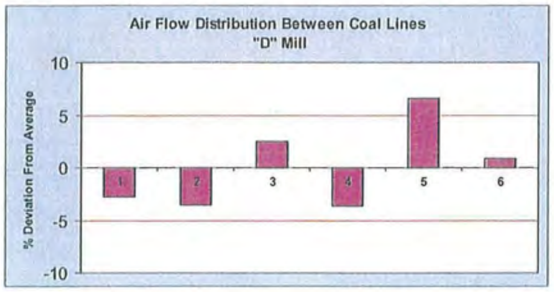
Anatoly

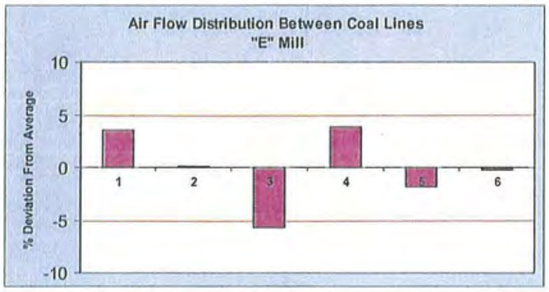
Dr. Anatoly Sobolevskiy

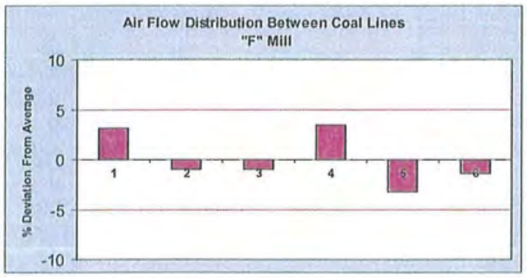
Principal Engineer
Boiler Technology Service
Siemens Power Generation
Tel: (407) 736-5831
Fax: (407) 736-2266
Cell: (407) 232-3927

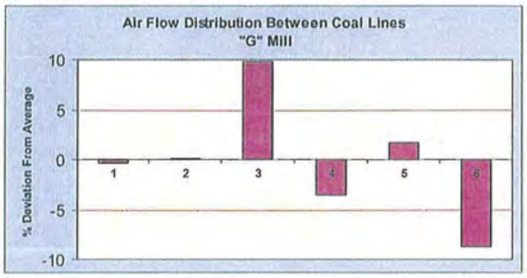

Air Flow Distribution Between Coal Lines
"A" Mill
% Deviation From Average

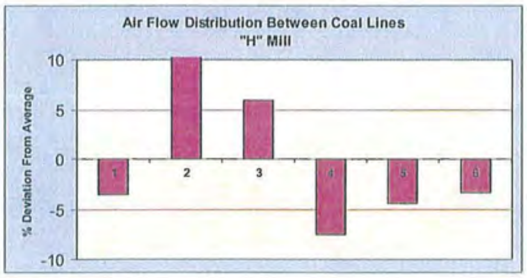

Air Flow Distribution Between Coal Lines
"B" Mill
% Deviation From Average

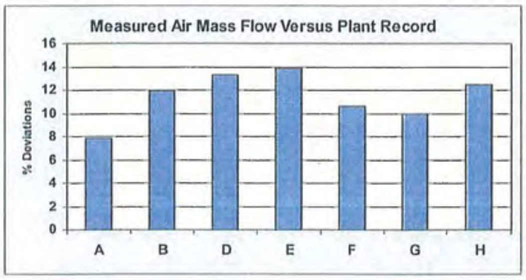

Air Flow Distribution Between Coal Lines
"D" Mill
% Deviation From Average


Air Flow Distribution Between Coal Lines
"E" Mill
% Deviation From Average

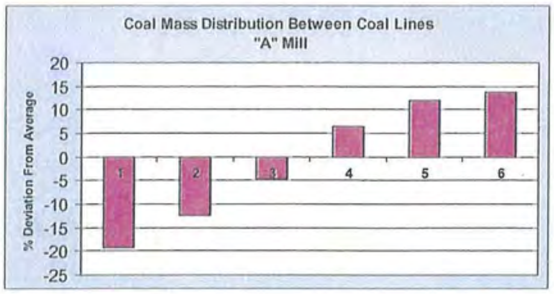

Air Flow Distribution Between Coal Lines
"F" Mill
% Deviation From Average

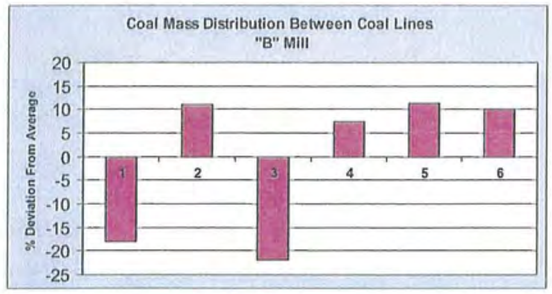

Air Flow Distribution Between Coal Lines
"G" Mill
% Deviation From Average

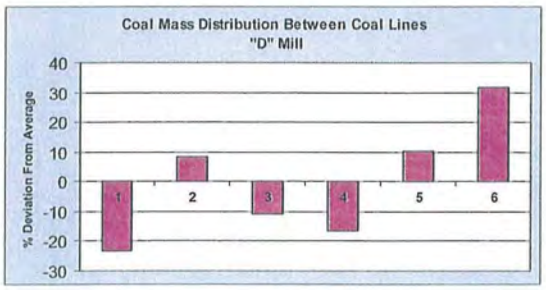

Air Flow Distribution Between Coal Lines
"H" Mill
% Deviation From Average

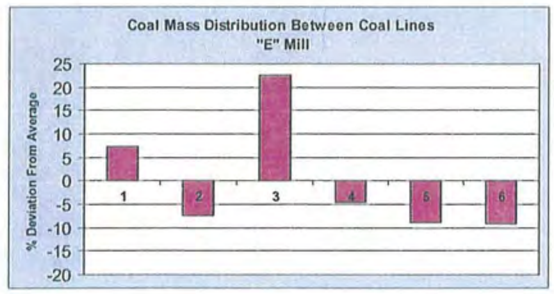

Measured Air Mass Flow Versus Plant Record
% Deviations
A
B
D
E
F
G
H

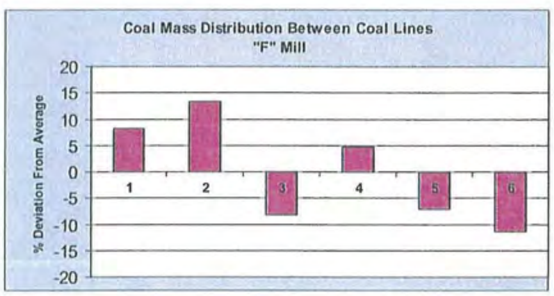
IP7021760

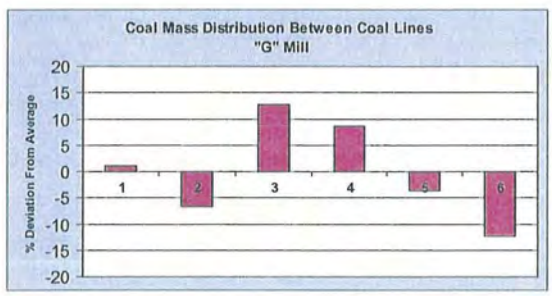

Coal Mass Distribution Between Coal Lines
"A" Mill
% Deviation From Average
20
15
10
5
0
-5
-10
-15
-20
-25
1
2
3
4
5
6

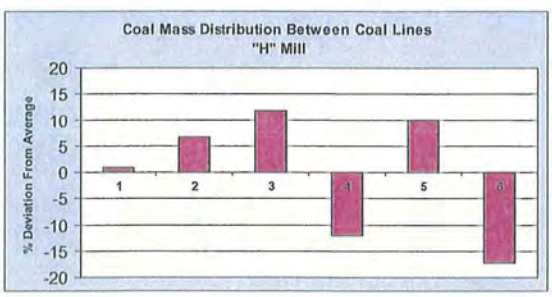

Coal Mass Distribution Between Coal Lines
"B" Mill
% Deviation From Average
20
15
10
5
0
-5
-10
-15
-20
-25
1
2
3
4
5
6

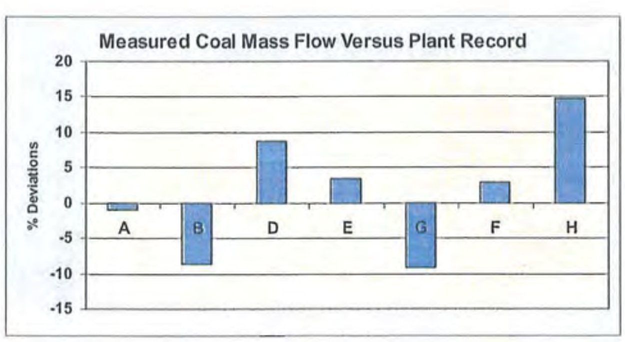

Coal Mass Distribution Between Coal Lines
"D" Mill
% Deviation From Average
40
30
20
10
0
-10
-20
-30
1
2
3
4
5
6

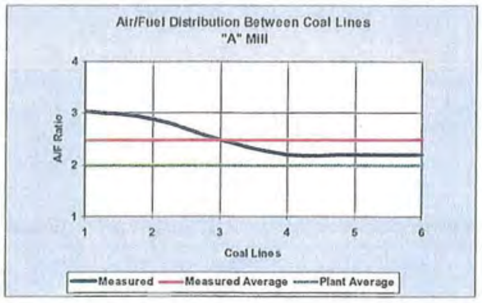

Coal Mass Distribution Between Coal Lines
"E" Mill
% Deviation From Average
25
20
15
10
5
0
-5
-10
-15
-20
1
2
3
4
5
6

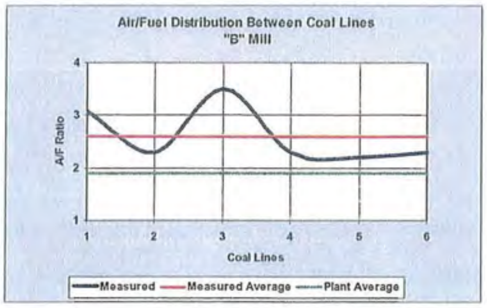

Coal Mass Distribution Between Coal Lines
"F" Mill
% Deviation From Average
20
15
10
5
0
-5
-10
-15
-20
1
2
3
4
5
6

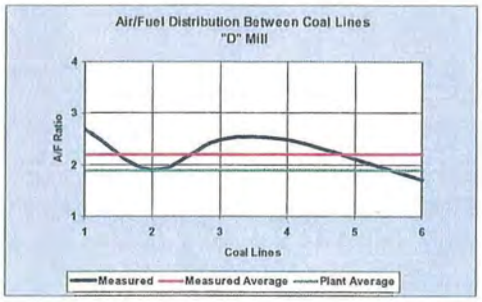

Coal Mass Distribution Between Coal Lines
"G" Mill
% Deviation From Average
20
15
10
5
0
-5
-10
-15
-20
1
2
3
4
5
6

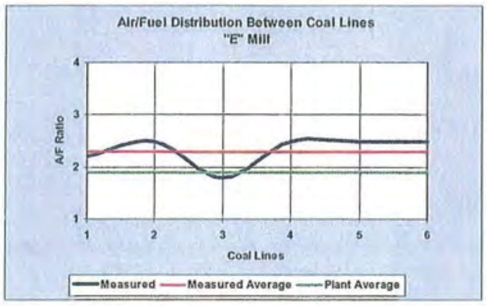

Coal Mass Distribution Between Coal Lines
"H" Mill
% Deviation From Average
20
15
10
5
0
-5
-10
-15
-20
1
2
3
4
5
6

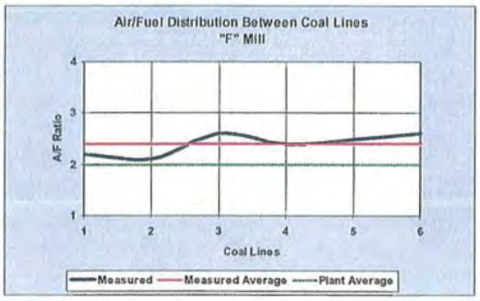

Measured Coal Mass Flow Versus Plant Record
% Deviations
20
15
10
5
0
-5
-10
-15
A
B
D
E
G
F
H

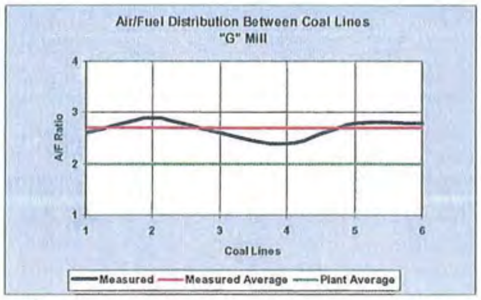

Air/Fuel Distribution Between Coal Lines
"A" Mill
A/F Ratio
Coal Lines
Measured
Measured Average
Plant Average

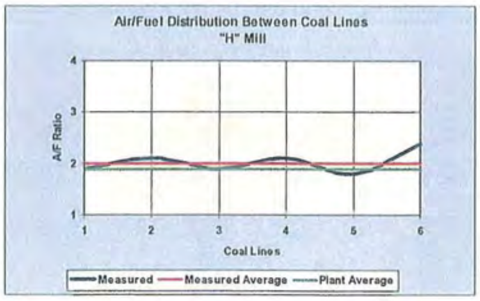

Air/Fuel Distribution Between Coal Lines
"B" Mill
A/F Ratio
Coal Lines
Measured
Measured Average
Plant Average


Air/Fuel Distribution Between Coal Lines
"D" Mill
A/F Ratio
Coal Lines
Measured
Measured Average
Plant Average


Air/Fuel Distribution Between Coal Lines
"E" Mill
A/F Ratio
Coal Lines
Measured
Measured Average
Plant Average


Air/Fuel Distribution Between Coal Lines
"F" Mill
A/F Ratio
Coal Lines
Measured
Measured Average
Plant Average


Air/Fuel Distribution Between Coal Lines
"G" Mill
A/F Ratio
Coal Lines
Measured
Measured Average
Plant Average


Air/Fuel Distribution Between Coal Lines
"H" Mill
A/F Ratio
Coal Lines
Measured
Measured Average
Plant Average

IP7021762

Durablock Inclined - Vertical Manometers .826 sp grav red gauge oil

S:\I4EDATA\AIR MONITOR\50271_PA_TEMPLATE XP1.xls

notes cal pressure 6.8007 "wc @ span of 300,000 lbm/hr
24"HG & 600°F

3-1-07 Coal flow within 3% total

with Siemens measured using heat balance around with their air flow 3% high (Siemens' coal flow)

Bob Allen with PI air flow 10.6% low our coal (PI)

Jerry Hinte

Richard Schmidt

Scott Robison HE 297 casting higher C & silicon, material is what it is suppose to
Cracks from baffle end, slow continual process

Dennis Killian erosion appears to be major contributor - primary mechanism

Jaber Nesm

Jerry Christensen 276,000 lb/hr compared to 231,000 lb/hr
13% air flow

industry 85 fps velocity max velocity

~~st~~ cracks start elbow side & go towards tip.
cracks are continuing

4.85% by wt evap coal flow
6.5 millon BTU to evap
Seal air 55,000 BTU Seal air 147 from 133

267,000 lb/hr for heat balance data

designing to 269,000 lb/hr

INTERMOUNTAIN POWER SERVICE CORPORATION

CONFIRMATION: (435) 864-4414 EXT. 6577

FACSIMILE: (435) 864-6670

FACSIMILE COVER SHEET

DATE: July 10, 2007

TO: COMPANY NAME: Siemens Power Generation

ATTENTION: Robert Allen

FACSIMILE #: (407) 736-2266

FROM: Garry Christensen EXT: 6486

DEPT: Technical Services

PAGES TO FOLLOW: 1

COMMENTS: Permission For testing at IPSC

DATE & TIME SENT: 7.10.07 ~~AM~~ 1:14

CONFIRMATION BY:

APPROVED BY:

850 WEST BRUSHWELLMAN ROAD, DELTA, UT 84624-9546

IP7021764

380 Tons/hr (2000 lb/ton) = 760,000 lbs coal/hr

760,000 / 7 pulv I/s = 108,571.4 lbs coal/hr per pulv (54.3 Tph)

1.8 - 2.0 lbs primary air / lb coal

(108,571.4 lbs coal/hr) (2.0 lbs primary air / lb coal) = 217,143 lbs air/hr

+ 5% 399 TPH ⇒ 114,000 lb coal/hr (57.0 TPH)

(114,000 lbs coal/hr) (2.0 lbs primary air / lb coal) = 228,000 lbs PA/hr

68 TPH → 136,000 lbs coal/hr $\xRightarrow{(2.0)}$ 272,000 lbs PA/hr

$\xRightarrow{(1.8)}$ 244,800 lbs PA/hr

To stay under 85 fps (5100 ft/min) velocity in coal lines

limit 270,000 lbs/hr PA flow

ρ = .0611

To stay over 55 fps (3300 ft/min) velocity in coal lines

Flow = vel * ρ * area min flow 174,595 lb/hr

TOPS 35500

IP7021765

From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 8/2/2007 2:18 PM
Subject: RE: numbers and calcs

Garry,
We agree that 269,000 lb/hr represents the upper limit for primary air flow into the pulverizer for the model. However, we have to agree that the model is representative of the actual maximum operating condition of the pulverizer to proceed forward. My CFD modeler is on hold until we agree. I thought that we all agreed in the staff meeting that was reasonably expected to represent the pulverizer performance that we measured. If this is not the case, I cannot proceed.
Bob Allen

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Thursday, August 02, 2007 2:40 PM
To: Allen, Robert J O642
Subject: RE: numbers and calcs

Bob, we agreed that 269,000 lb/hr should be the upper limit of the model. It falls around the 85 fps velocity we want to stay under. I am just trying to find out why our numbers are off from yours. E pulverizer data was checked by heat balance and so far it appears to be close to your value but the heat balance on the other pulverizers are much closer to the plant data. I am just checking to see if we have a system issue or just a pulverizer issue. We still plan on getting them all tested.

Garry Christensen

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486

>>> "Allen, Robert J O642" <robertj.allen@siemens.com> 8/2/2007 12:01 PM
>>>
Garry,

I have outlined the heat balance calculations that I went over with you yesterday. However, I thought that we had agreed on using the test data from the BTS test, derated 3% to 269,000 lb/hr. If we do not have agreement, I need to schedule a flight back to your plant. I have been told by my boss that if we do not have agreement, I cannot proceed and therefore I will need to meet with the staff again and stay until we have agreement.

Bob Allen

Meeting Minutes; Siemens and IPSC; Concerning ABT Burner Questions submitted prior to arrival.
July 2, 2007

A meeting was held Thursday, June 21, 2007 at IGS with Siemens representative to review data on questions submitted to IPSC June 19, 2007. Mr. Allen arrived around 8:30am.

Present at the meeting were:

Robert Allen;	Performance Engineer	Siemens
Dean Wood	Supervising Engineer	IPSC
Garry Christensen	Lead Engineer	IPSC
Richard Schmidt	Operations Assistant Superintendent	IPSC
Lynn Thomas	Operations Control Operator	IPSC
Mark Shipley	Operations Unit Operator	IPSC

Mr. Allen came to review data on questions submitted to IPSC and to determine the sizing for the new burner design. The B&W Pulverizer Coordination Curves were gone over to determine how the original sizing came about and operating data along with correspondence from B&W concerning MPS 89G Standards were gone over to size the new burners. A value of 380 tons per hour with a range of 5% was agreed upon. The value of 239,000 lb/hrs primary air flow was used. The pounds of primary air per pound of coal fell within the range1.8 - 2.0 lbs which is an industry standard. A copy of the page in the Utah Air Quality permit stating the maximum burner heat input was given.

Cooling air measurements and temperature set points were discussed along with the inability to get cooling air to areas on the existing ABT burner.

On the questions concerning the operating procedures of taking pulverizers in and out of service was answered by IPSC operations people. A copy of the procedure was given to Bob to take back.

Mr. Allen proposed testing all of Unit 2 pulverizers in the later part of July. Mr. Allen's intent following the meeting is to get with his test group and decide on a test period and then contact IPSC ~~as~~ to see if the dates will work for both parties. Prior to Mr Allen leaving the plant site, the testing was discussed with operations and maintenance and both agreed to cooperate with the testing. Mr. Allen was also shown burner front flames and the caps on C burner front (the out of service pulverizer) was unscrewed to show ash deposition at the tips of out of service burners.

The meeting adjourned at 12:25 pm

6-21-07

nominal burner heat input boiler @ full load with one mill out of service = 192 M BTU/hr

(1 Pulv / 6 burners) (50.09 tons/hr) (11,500 BTU/lb) (2000 lb/ton) = 192 M BTU/hr

max 220 M BTU/hr → 57.39 tph 402 TPH total
115% of rated

From Pulv Coordination Curves - Coal B (in Addendum)
get for 6900 M lb/hr = 110 M lb/hr → 55.0 TPH

From Curve @ 63,500 ft³/min

@ 150°F + 29.92" Hg ⇒ ρ 0.0651 lb/ft³

(63,500 ft³/min)(0.0651 lb/ft³) * 60 min/hr = 248,031 lb/hr @ 55.0 TPH

+5% ⇒ 260,433 lb/hr

#'s with → Bob Allen

$$9500 = \frac{(2000)(11,500)(X)}{(900)(1000)}$$

X = 372 tph

53.14 TPH

1.8-2.0 lb hr air / lb coal

use 380 TPH + 5% → 399 TPH

63,500 ft³/

(248 M BTU/hr) per burner permit

Blr 9225 M BTU/hr

TOPS 35500

IP7021768

2. All definitions, terms, abbreviations, and references used in this AO conform to those used in the Utah Administrative Code (UAC) Rule 307 (R307) and Title 40 of the Code of Federal Regulations (40 CFR). Unless noted otherwise, references cited in these AO conditions refer to those rules.

3. The limits set forth in this AO shall not be exceeded without prior approval in accordance with R307-401.

4. Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved in accordance with R307-401-1.

5. All records referenced in this AO or in applicable NSPS and/or NESHAP and/or MACT standards, which are required to be kept by the owner/operator, shall be made available to the Executive Secretary or Executive Secretary's representative upon request, and the records shall include the five-year period prior to the date of the request. Records shall be kept for the following minimum periods:

A.	Emission inventories	Five years from the due date of each emission statement or until the next inventory is due, whichever is longer.
B.	All other records	Five years

6. Intermountain Power Service Corporation (IPSC) shall use synfuel Covol 298-1 as an alternative fuel in the Unit #1 and #2 Main boilers and shall conduct its operations of the Intermountain Generating Station (IGS) coal fired electric steam plant in accordance with the terms and conditions of this AO, which was written pursuant to IPSC's Notice of Intent submitted to the Division of Air Quality (DAQ) on October 21, 2004, and February 22, 2005..

7. This AO shall replace the AO (DAQE-AN03270009-04) dated February 27, 2004. as determined by state

8. The approved installations shall consist of the following equipment or equivalent(*):

A. Unit #1 Coal Fired Boiler (Subject to NSPS, Subpart Da) equipped with Low NO_x burners with maximum heat input of 248 MMBtu/hr per each burner.
Rating - $9{,}225 \times 10^6$ Btu/hr (MMBtu/hr)
B. Unit #2 Coal Fired Boiler (Subject to NSPS, Subpart Da) equipped with Low NO_x burners with maximum heat input of ~~248 MMBtu/hr per each~~ ~~[illegible]~~
Rating - ~~9,225 MMB[illegible]~~ - boiler heat input from Combustion
C. Coal railcar unloading dust collector 1A
D. Coal railcar unloading dust collector 1B
E. Coal railcar unloading dust collector 1C
F. Coal railcar unloading dust collector 1D
G. Coal truck unloading dust collector 2
H. Coal reserve reclaim dust collector 3
I. Coal transfer building #1 dust collector 4
J. Coal transfer building #2 dust collector 5
K. Coal transfer building #4 dust collector 6

From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: "Garry Christensen" <Garry-C@ipsc.com>, "Cochran, Thomas A O64" <thomas....
Date: 6/8/2007 1:41 PM
Subject: IPSC Warranty Program Status Report 6-1-2007.doc

CC: <Dean-W@ipsc.com>, "Ferrara, Sal N O6473" <sal.ferrara@siemens.com>
Attached is the June 1 status report for the Intermountain Power Service Corp Warranty Investigation

---

Intermountain Warranty Claim #2007-01

Status Report - June 1, 2007

Issue Statement

The Six Sigma process requires the creation of an issue statement as part of the Define phase. After consultation with Intermountain Power Service Corp. and ABT, we have agreed on the following five issues:

1.) The alloy nozzle tip is cracking

2.) There is material loss at the following locations:

* The burner nozzle tip
* The "X" vane at the coal pipe elbow
* The burner barrel

3.) The burner barrel is experiencing permanent deformation

4.) Establish the correct primary airflow for normal operation

5.) Definition of requirements for cooling air when the burner is out of service

The goal of this program is determine a solution to the five stated issues that will result in satisfactory operation of the Siemens supplied product for all parties.

Communications

The following people will be included as part of the Six Sigma investigation:

Participants

BTS

Robert Allen - Program manager

Tom Cochran - Director of BTS

Dan Wagester - Manager of QA

Michael Davidson - Manager of Engineering

Eugene Corban - Siemens Six Sigma advisor

Siemens Legal Counsel

Chris Flynn - Siemens Legal Advisor

Siemens Contract Administration

John Gallagher - Siemens Contract Administrator

ABT

Joel Vatsky - President of ABT

Sal Ferrara - Director of Proposals and Projects

IPSC

Garry Christensen - Performance Engineer

Dean Woods - Contract Administration

Status reports shall be issued once every two weeks to all participants. All correspondence shall be routed through the Project Manager, Robert Allen.

Requests for information shall be sent via email. All requests for information from ABT shall be addressed to Joel Vatsky, copy to Sal Ferrara. All requests for information from IPSC shall be addressed to Garry Christensen, copy to Dean Woods. Expeditious responses to emails shall be required within 72 hours. If there is no response, it shall be assumed that the addressee has no input to offer and a decision shall be formulated at that point based on the available information at that time.

Meetings shall be scheduled once each month at the IPSC site in Delta Utah between the Project Manager and IPSC staff to status IPSC on their warranty claim.

The investigation is in the Define stage. The next step will be the interview process at ABT for the collection of design data and the interview process at IPSC for the collection of data. It is anticipated that the Define stage shall be completed this month.

Robert Allen

Project Manager

Siemens Power Generation Corp

407 736 2867

Meeting Minutes; Siemens and IPSC; Concerning ABT Burners
May 21, 2007

A meeting was held last Friday, May 18, 2007 at IGS with a Siemens representative to discuss progress in resolving issues with our ABT burners on Unit 2. The meeting came to order at 09:00.

Present for this meeting were:

Robert Allen;	Performance Engineer;	Siemens
Jon Finlinson;	Superintendent of Operations	IPSC
Will Lovell;	Assistant Superintendent of Maintenance	IPSC
Dean Wood	Supervising Engineer	IPSC
Garry Christensen	Lead Engineer	IPSC

Mr. Allen hand-delivered a letter from Mr. Thomas Cochran which stated Siemens intent to determine the cause of the failure of the ABT burners on IPP Unit 2. Their intent is to use Six Sigma methodology to get to the root cause and formulate a resolution. Mr. Allen assured us that it is their intent to have recommendations/modifications for our burners designed by August 2007 and that that will be adequate lead time to have replacement parts to the plant site before the start of our Unit 2 outage in April 2008.

The purpose of this meeting, from Siemens standpoint, was to gain IPSC's agreement on the key issues regarding the ABT burner failures. ABT has "agreed to agree" that the following are the issues:

1. The burner nozzles cracked
2. There is material loss on the following:
    - The nozzle tips
    - The burner barrels
    - The x-vane diffusers
3. Permanent deformation of the burner barrel occurred
4. There is disagreement between IPSC and ABT as to Primary Air Flow.

We understand number 4. above to mean that the primary air flow that should have been used to design the burners is what is disagreed upon.

Garry Christensen asked that we add one more issue. <u>The Flow Divider; that is, the annular tube that surrounds the burner barrel and nozzle, is deformed permanently at the furnace end.</u> Garry indicated that many of the burners experienced this deformation. Mr. Allen asked for photographs of this damage and Garry agreed to e-mail them to Mr. Allen.

We agreed that the five issues sited above are the key burner issues to be focused on.

We affirmed that future meetings may be coordinated through Garry Christensen in Engineering.

Dean Wood raised the concern that all the time spent performing Six Sigma analysis is eating away the lead time required to have the needed materials on site to repair the burners next April. Waiting until August essentially forces IPSC to go with whatever Siemens proposes. Mr. Allen offered assurance that Siemens will come up with a good resolution and that August is early enough for ABT to build whatever fix is necessary.

Mr. Allen's intent following this meeting is to get back to ABT to secure agreement on the fifth "issue" proposed by Garry Christensen then to proceed with the next step in the Six Sigma process as outlined in Mr. Cochran's letter.

The meeting was adjourned at 09:45.

nozzle tip cracking
material loss on nozzle tips, burner barrel & X-vane
permanent deformation burner barrel
ABT & IPSC disagree on primary air

Send pictures of sleeve to

TOPS 35500

April 2, 2007

Mr. George W. Cross
Intermountain Power Service Corporation
850 W. Brush Wellman Road
Delta, Utah 84624-9546

Subject: Actions to Date on Intermountain Power Service Corporation Unit #2 Burners

Dear Mr. Cross,

As a result of the my recent meeting with you and the IPSC Staff, I assigned Robert Allen as Project Manager to work on resolution of the issues experienced by IPSC with the ABT product.

Robert Allen traveled to the IPSC site and met with Gary Christensen on March 22nd. Gary was very helpful and cooperative in supplying information regarding the situation. Information exchanged included operating parameters, burner photographs, correspondence between IPSC and ABT, and a copy of the contract. Also, Mr. Allen obtained a sample of a burner nozzle previously removed from service and transported it back to the Siemens Boiler Technology Services (BTS) offices in Orlando, Florida.

Mr. Allen was able to identify four separate problems as a result of his observations of the failed burner components from IPSC Unit #2:

- Erosion in the burner nozzle.
- Cracking in the burner nozzle
- Distortion in the straight pipe connection of the burner nozzle to the coal piping
- Erosion in the turning vanes in the coal piping connecting to the burner

On March 26th, BTS contacted an outside metallurgical laboratory, Tordonato Energy Consultants (TEC), and arranged for the nozzle segment to be metallurgically analyzed. The segment was shipped to the metallurgical lab on Tuesday, March 27th and was received by Fred Ellis of TEC on Thursday, March 29th. Fred Ellis did a preliminary examination on Thursday and Friday. Mr. Allen discussed preliminary results with Fred Ellis on Friday March 30th and again on Wednesday April 4th. His initial examination indicated that there are two independent metallurgical phenomena occurring in the segment. Erosion is being observed as an ongoing event and independent of the cracks. The cracks appear to be fatigue cracks. The cracks have been occurring at different times, as indicated by the varying amounts of erosion on the cracks. Analysis will continue this week with spectral analysis, macro photographs and polished samples. A written report is expected the week of April 9th.

Near Term Planned actions:

- Investigation of burner nozzle material properties
- Cataloging and analysis of the material received by R. Allen from G. Christensen

Next Term Actions:

- Kepner Tragoe Root Cause Analysis
- Presentation of Results to IPSC
- Action Plan to Resolve Outstanding Items

We at Siemens appreciate your consideration and patience in granting us an opportunity to investigate the problem and work on a solution that will be acceptable and beneficial to IPSC. Siemens considers IPSC a valued customer and I assure you that I have given resolution of this problem my highest priority and have assigned my most experienced engineers to the task of investigating and resolving this issue. If you have any questions or concerns, please do not hesitate to contact myself (407) 736 - 4258 or Mr. Robert Allen (407) 736 – 2867.

Respectfully,

Thomas Cochran

Thomas Cochran
Siemens Power Generation Corp.
Boiler Technology Services
4400 N. Alafaya Trail
Orlando, Fl 32826

From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: "Garry Christensen" <Garry-C@ipsc.com>
Date: 3/20/2007 6:40 AM
Subject: RE: ABT burner tip erosion - pictures looking down burnernozzle

Garry,
I am going to try and get a flight out tomorrow so that I can meet with you on Thursday. I would like to discuss the history of the burner problems, the operation of the burners and if possible, get a sample of one of the failed areas so that I can get a metallurgical analysis performed.

Thanks,
Bob Allen

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Monday, March 19, 2007 4:30 PM
To: Allen, Robert J O642
Subject: RE: ABT burner tip erosion - pictures looking down burnernozzle

I will not be in this Friday but Thursday of this week or first part of next week Tuesday will work. I do have testing Monday so Tuesday would be better for me but if Monday is better for you I will adjust. Let me know. Thanks

>>> "Allen, Robert J O642" <robertj.allen@siemens.com> 3/19/2007 2:11 PM
>>>
Garry,

Thanks for the pictures. I don't think that I need anymore pictures at this point, but I could use some operating data. I think that I am going to have to come out and look at the burners in person and speak directly to you when I have a handle on the problem. I will probably travel out either the end of this week or beginning of next week. Would either of these times be OK with you.

Bob Allen

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Monday, March 19, 2007 3:59 PM
To: Allen, Robert J O642
Subject: ABT burner tip erosion - pictures looking down burner nozzle

Bob, attached are a single picture of each burner tip on "A" burner row. I can send you a picture of each burner tip taken from the elbow looking down the coal nozzle if you would like or need all rows. I have many pictures of when they were pulled but I do not want to send you pictures you don't need. I will also send some operating data also.

"A" burner row is the 3rd row up out of 4 on the front of the boiler. We have four burner levels with 6 burners per row. Opposed fire boiler with 8 pulverizers in all.
burner rows

level	Front wall	Rear wall
4th	E	D
3rd	A	H
2nd	F	C
1st	B	G

From: "Allen, Robert J O642" <robertj.allen@siemens.com>
To: <garry-c@ipsc.com>
Date: 3/19/2007 12:39 PM
Subject: ABT Burner Investigation

CC: "Davidson, Michael J O642" <michael.davidson@siemens.com>

Garry,

I have been assigned to the investigation for the ABT burners at Unit 2 of your Intermountain Power site. I am starting the fact finding portion of this investigation and I am starting to gather information.
Tom Cochran told me that you would be an excellent contact for information relating to the performance of the ABT burners.
Could you please email me the photographs you have and any information regarding the coal analysis, ash analysis, primary and secondary air temperatures and flows the unit is operating at presently.
Also, did you have similar problems with the previous B&W burners?

I will try to arrange a conference call with you later this week.

Thanks,

Robert J. Allen
Performance Engineer
Siemens Power Generation Corporation
4400 N. Alafaya Trail
Orlando, FL 32826

email: robertj.allen@siemens.com
Phone: 407 736 2867
Cell: 407 666 7753

From: Jerry Hintze
To: Dennis Killian; George Cross
Date: 3/22/2007 2:53 PM
Subject: Bob Allen - Siemens

CC: Garry Christensen; Wood, Dean

Mr. Allen works in the engineering department for Siemens and he will be responsible for CFD modeling of the burner and FEA of the nozzle tip. He will also be heading up the process of coming up with a recommended solution for our problem.

Garry reviewed past operating data and took him out and showed him the burner nozzles west of Unit 2. Mr. Allen took some of the nozzle material for metallurgical analysis. He did not admit to being a burner expert but, he had many years of experience in the industry. The engineer who will be doing the models formally worked for B&W and was involved with the original design of their low NOx burners. He did not believe that this will be a difficult problem to resolve.

They will get the original design information from ABT but, plan to work independently on the design solution. He indicated that they should have a proposal to us in two - three weeks with their recommended solutions.

Mill	Feeder Speed%	Traverse Flow LBS/HR.	Flow Element Flow LBS/HR.	DCS Flow LBS/HR.	Flow Element VS. Traverse Error%	[redacted]
A	70	234,822	219,616	229,872	-6.48	
A	85	243,946	230,206	240,655	-5.63	
B	70	227,537	210,529	214,755	-7.47	
B	90	243,554	225,305	231,093	-7.49	
C	70	223,714	207,535	214,695	-7.23	
C	90	231,590	214,671	223,630	-7.31	
D	70	239,019	223,336	232,562	-6.56	
D	70	240,258	223,885	232,802	-6.81	
E	55	215,316	199,804	202,460	-7.20	
E	70	226,653	210,673	215,352	-7.05	
E	90	243,405	225,855	230,445	-7.21	
F	55	212,976	195,612	202,080	-8.15	
F	70	225,157	207,716	214,640	-7.75	
F	90	243,396	223,831	231,180	-8.04	
G	70	241,615	225,035	229,900	-6.86	
G	90	258,191	240,614	245,229	-6.81	
H	70	226,387	209,902	214,822	-7.28	
H	90	243,815	226,085	230,834	-7.27	

Preliminary Results of Primary Air Traverse Testing On Unit 2 by Air Monitor August 14-16, 2007

The preliminary results of the testing showed that the DCS flow values were reading 4.38% lower than the manual traverse values over all the testing. Air Monitors plan is to get their probe and box calibration checked in a wind tunnel and then provide recommendations. They stated that manual traverse test accuracy is +/- 7.5% and their flow element is +/- 3%. The average of the tests on each pulverizer's DCS value compared to the traverse value is as follows:

A Pulv	-1.73%	(DCS value lower than traverse value)
B Pulv	-5.37%	
C Pulv	-3.73%	
D Pulv	-2.90%	
E Pulv	-5.43%	
F Pulv	-4.94%	
G Pulv	-4.94%	
H Pulv	-5.22%	

Since all traverse testing values were higher than the values to the DCS , Air Monitor recommended to wait until the calibration on their probe was checked before giving any final recommendations.

Below is the flow values (lbs/hr) measured on the upper test ran on each pulverizer:

	Traverse Flow	DCS Flow
A Pulv 85% fdr speed, 5% air bias	243,946	240,655
B Pulv 90% fdr speed	243,554	231,093
C Pulv 90% fdr speed	231,590	223,630
D Pulv 70% fdr speed, 6% air bias	239,639	232,682
E Pulv 90% fdr speed	243,405	230,445
F Pulv 90% fdr speed	243,396	231,180
G Pulv 90% fdr speed, 5% air bias	258,191	245,229
H Pulv 90% fdr speed	243,815	230,834

IP7021783

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...ision of Air Monitor Corporation

Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	1
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	239	239
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	48.20	48.20
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	29.04	29.04		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	107.66	99.90		
ACTUAL VOLUME (ACFM)	65,132	60,439	-7.21	
STANDARD VOLUMETRIC FLOW (SCFM)	47,764	44,323	-7.20	
MASS FLOW (LBS/HR)	215,316	199,804	-7.20	-5.971

DCS reading 202,460

DUCT DESCRIPTION/PLANT CONDITIONS:

Mill E 55% Feeder Speed

Mill E 55% feeder
8/17/2007

IP7021784

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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	1
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	259	259
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	47.27	47.27
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.98	28.98		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	116.91	108.66		
ACTUAL VOLUME (ACFM)	70,728	65,741	-7.05	
STANDARD VOLUMETRIC FLOW (SCFM)	50,279	46,734	-7.05	
MASS FLOW (LBS/HR)	*226,653*	*210,673*	-7.05	**-4.986**

DCS reading 215,352

DUCT DESCRIPTION/PLANT CONDITIONS:

E Mill 70% Feeder speed

Mill E 70% feeder
8/17/2007

IP7021785

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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	1
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	285	285
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	46.29	46.29
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.90	28.90		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	130.37	120.97		
ACTUAL VOLUME (ACFM)	78,871	73,185	-7.21	
STANDARD VOLUMETRIC FLOW (SCFM)	53,995	50,102	-7.21	
MASS FLOW (LBS/HR)	243,405	225,855	-7.21	-5.324

DCS reading 230,445

DUCT DESCRIPTION/PLANT CONDITIONS:

Mill E 90% Feeder speed

Mill E 90% feeder
8/17/2007

IP7021786

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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	1
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	249	249
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	47.22	47.22
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.97	28.97		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	108.24	99.41		
ACTUAL VOLUME (ACFM)	65,484	60,144	-8.15	
STANDARD VOLUMETRIC FLOW (SCFM)	47,245	43,393	-8.15	
MASS FLOW (LBS/HR)	212,976	195,612	-8.15	-5.116

DCS reading 202,080

DUCT DESCRIPTION/PLANT CONDITIONS:

Mill F 55% Feeder speed

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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	269	269
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	46.41	46.41
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.91	28.91		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	118.02	108.88		
ACTUAL VOLUME (ACFM)	71,405	65,874	-7.75	
STANDARD VOLUMETRIC FLOW (SCFM)	49,947	46,078	-7.75	
MASS FLOW (LBS/HR)	225,157	207,716	-7.75	**-4.671**

DCS reading 214640

DUCT DESCRIPTION/PLANT CONDITIONS:

Mill F 70% Feeder speed

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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	3
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	299	299
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	45.42	45.42
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.84	28.84		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	133.07	122.37		
ACTUAL VOLUME (ACFM)	80,507	74,036	-8.04	
STANDARD VOLUMETRIC FLOW (SCFM)	53,993	49,653	-8.04	
MASS FLOW (LBS/HR)	243,396	223,831	-8.04	-5.019

DCS reading 231,180

DUCT DESCRIPTION/PLANT CONDITIONS:

Mill F 90% Feeder speed

IP7021789

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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	259	259
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	45.77	45.77
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.87	28.87		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	125.09	116.50		
ACTUAL VOLUME (ACFM)	75,678	70,485	-6.86	
STANDARD VOLUMETRIC FLOW (SCFM)	53,598	49,920	-6.86	
MASS FLOW (LBS/HR)	241,615	225,035	-6.86	**-4.849**

DCS reading 229,900

DUCT DESCRIPTION/PLANT CONDITIONS:

Mill G 70% Feeder speed

Mill G 70% Feeder
8/17/2007

AMC POWER
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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	**Traverse**	**Flow Element**
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	290	290
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	44.86	44.86
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	**Traverse**	**Flow Element**	**% Difference**	**DCS %Error**
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.80	28.80		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	139.79	130.27		
ACTUAL VOLUME (ACFM)	84,572	78,814	-6.81	
STANDARD VOLUMETRIC FLOW (SCFM)	57,275	53,376	-6.81	
MASS FLOW (LBS/HR)	258,191	240,614	-6.81	**-5.020**

DCS reading 245,229

DUCT DESCRIPTION/PLANT CONDITIONS:

Mill G 90% Feeder speed

Mill G 90% Feeder
8/17/2007

IP7021791

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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	274	274
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	46.24	46.24
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.90	28.90		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	119.51	110.81		
ACTUAL VOLUME (ACFM)	72,306	67,041	-7.28	
STANDARD VOLUMETRIC FLOW (SCFM)	50,220	46,563	-7.28	
MASS FLOW (LBS/HR)	226,387	209,902	-7.28	-5.109

DUCT DESCRIPTION/PLANT CONDITIONS:

DCS reading 214,822

Mill H 70% Feeder speed

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Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	302	302
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	45.37	45.37
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.84	28.84		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	133.78	124.05		
ACTUAL VOLUME (ACFM)	80,937	75,051	-7.27	
STANDARD VOLUMETRIC FLOW (SCFM)	54,086	50,153	-7.27	
MASS FLOW (LBS/HR)	243,815	226,085	-7.27	-5.324

DUCT DESCRIPTION/PLANT CONDITIONS:

DCS reading 230,834

Mill H 90% Feeder speed

Mill H 90% Feeder
8/17/2007

IP7021793

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ision of Air Monitor Corporation

Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	290	290
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	46.45	46.45
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.92	28.92		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	126.61	118.42		
ACTUAL VOLUME (ACFM)	76,602	71,642	-6.48	
STANDARD VOLUMETRIC FLOW (SCFM)	52,091	48,718	-6.48	
MASS FLOW (LBS/HR)	234,822	219,616	-6.48	-2.108

DUCT DESCRIPTION/PLANT CONDITIONS: DCS reading 229,872

Mill A 70% Feeder speed

Mill A 70% Feeder)
8/17/2007

IP7021794

AMC POWER
A Division of Air Monitor Corporation

Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	315	315
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	45.94	45.94
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.88	28.88		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	136.11	128.44		
ACTUAL VOLUME (ACFM)	82,345	77,708	-5.63	
STANDARD VOLUMETRIC FLOW (SCFM)	54,115	51,067	-5.63	
MASS FLOW (LBS/HR)	243,946	230,206	-5.63	-1.349

DUCT DESCRIPTION/PLANT CONDITIONS: DCS reading 240,655

Mill A 85% Feeder speed

Mill A 85% Feeder)
8/17/2007

IP7021795

AMC POWER
Division of Air Monitor Corporation

Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	275	275
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	47.62	47.62
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	29.00	29.00		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	119.87	110.91		
ACTUAL VOLUME (ACFM)	72,523	67,101	-7.48	
STANDARD VOLUMETRIC FLOW (SCFM)	50,475	46,702	-7.47	
MASS FLOW (LBS/HR)	227,537	210,529	-7.47	-5.618

DUCT DESCRIPTION/PLANT CONDITIONS: DCS reading 214,755

Mill B 70% Feeder speed

Mill B 70% Feeder)
8/17/2007

IP7021796

AMC POWER
A Division of Air Monitor Corporation

Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	307	307
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	46.81	46.81
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.94	28.94		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	134.06	124.02		
ACTUAL VOLUME (ACFM)	81,109	75,032	-7.49	
STANDARD VOLUMETRIC FLOW (SCFM)	54,028	49,980	-7.49	
MASS FLOW (LBS/HR)	243,554	225,305	-7.49	-5.116

DUCT DESCRIPTION/PLANT CONDITIONS: DCS reading 231,093

Mill B 90% Feeder speed

IP7021797

AMC POWER
...ision of Air Monitor Corporation

Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	**Traverse**	**Flow Element**
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	301	301
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	47.34	47.34
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	**Traverse**	**Flow Element**	**% Difference**	**DCS %Error**
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.98	28.98		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	122.09	113.26		
ACTUAL VOLUME (ACFM)	73,865	68,523	-7.23	
STANDARD VOLUMETRIC FLOW (SCFM)	49,627	46,038	-7.23	
MASS FLOW (LBS/HR)	223,714	207,535	-7.23	**-4.032**

DUCT DESCRIPTION/PLANT CONDITIONS:

DCS reading 214,695

Mill C 70% Feeder speed

IP7021798

AMC POWER
...ision of Air Monitor Corporation

Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	325	325
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	47.49	47.49
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	28.99	28.99		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	130.36	120.84		
ACTUAL VOLUME (ACFM)	78,868	73,107	-7.30	
STANDARD VOLUMETRIC FLOW (SCFM)	51,374	47,621	-7.31	
MASS FLOW (LBS/HR)	231,590	214,671	-7.31	-3.437

DUCT DESCRIPTION/PLANT CONDITIONS: DCS reading 223,630

Mill C 90% Feeder Speed

IP7021799

AMC POWER
A Division of Air Monitor Corporation

Airflow Traverse Worksheet

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	270	270
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	47.63	47.63
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	29.00	29.00		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	124.93	116.73		
ACTUAL VOLUME (ACFM)	75,582	70,622	-6.56	
STANDARD VOLUMETRIC FLOW (SCFM)	53,022	49,543	-6.56	
MASS FLOW (LBS/HR)	239,019	223,336	-6.56	-2.701

DUCT DESCRIPTION/PLANT CONDITIONS: DCS reading 232,562

Mill D 70% Feeder speed

IP7021800

Airflow Traverse Worksheet

AMC POWER
A Division of Air Monitor Corporation

PROJECT:	Intermountain Power Unit# 2 Mills
WORK ORDER NO:	62971
DATE OF TEST:	8/14/07
TEST RUN:	2
3-D PROBE USED:	7' s/n C-4367
START/END TIMES OF TEST:	

TEST DATA:	Traverse	Flow Element
STANDARD TEMPERATURE (DEGREES F)	68	68
STANDARD BAROMETRIC PRESSURE (INCHES of Hg)	29.92	29.92
DUCT HEIGHT/DIAMETER (INCHES)	22.00	22.00
DUCT WIDTH (INCHES)	66.00	66.00
AVERAGE DUCT AIR TEMPERATURE (DEGREES F)	269	269
AVERAGE DUCT STATIC PRESSURE (INCHES of W.C.)	47.68	47.68
ACTUAL BAROMETRIC PRESSURE (INCHES of Hg)	25.50	25.50

CALCULATIONS:	Traverse	Flow Element	% Difference	DCS %Error
DUCT ABSOLUTE PRESSURE (INCHES of Hg)	29.01	29.01		
AREA (SQ. FT.)	10.08	10.08		
VELOCITY (FT/SEC)	125.50	116.95		
ACTUAL VOLUME (ACFM)	75,930	70,755	-6.82	
STANDARD VOLUMETRIC FLOW (SCFM)	53,297	49,665	-6.81	
MASS FLOW (LBS/HR)	240,258	223,885	-6.81	-3.103

DUCT DESCRIPTION/PLANT CONDITIONS: DCS reading 232,802

D mill 70% Feeder speed Repeat test

IP7021801

12:30 E Fdr 90% 7-31-07
14:00

E

(90
~~85~~ - 70 - 55)

Start 8:50
end 9:40

8-14-07 U2 PA traverse testing

@ 55% Fdr speed 08:50 @ 9:15 202,700, 237°F, 28.44
1.80 "WC

@ 9:37 20~~4~~,700, 243, 28.45, 1.73

(~~218.4~~) PI
202.461

did 8 of 9 ports, middle one left obstruction on top

9:53

9:45 @ 70% Fdr speed

start 9:53	214,200,	260°F,	28.45 "Hg	1.99 "WC
@ 10:07	208,400,	261°F,	28.42 "Hg,	1.96 "WC
@ 10:30	214,800,	256°F,	28.39 "Hg,	1.96 "WC

end 10:37
(215,352)

90% Fdr speed @ 10:35

start 10:40	229,700,	280°F,	28.39 "Hg,	2.34" WC
@ 10:54	223,400	283	28.33	2.31
@ 11:12	231,500	283	28.36	2.38

(230.4~~3~~5 ave)

end 11:15

preliminary probe to probe

-7.21	55%
-7.05	70%
-7.21	90% -5.5

to DCS
-5.9%
-~~4~~.99
-5.3

7' probe

8-14-07

F Pulv 13:03
55%

start

@ 13:12	201,900	258	28.86	1.58	port 1
	200,500	258	28.86	1.54	port 2
	202,000	258	28.86	1.56	port 3
	202,100	257	28.83	1.58	port 4
	203,500	255	28.85	1.61	port 5
	202,300	259	28.82	1.58	port 6
	202,100	258	28.86	1.58	port 7
	202,500	259	28.86	1.59	port 8
@ 14:03	203,000	260	28.84	1.61	port 9

PI ave
202.08

3 to 4 % low last time

-3.5 50%
-3.17 90%

-5.66

-5.44%

F 70% @ 14:10

@ 14:13	211,900	290	28.79	1.81	port 1
	211,100	284	28.76	1.79	port 2
	216,400	284	28.81	1.87	port 3
	207,900	282	28.73	1.72	port 4
	214,300	284	28.79	1.85	port 5
	213,000	279	28.74	1.82	port 6
	215,800	280	28.73	1.87	port 7
	216,000	279	28.77	1.87	port 8
@ 14:55	213,000	282	28.79	1.82	port 9

PI ave
214.64

Flow vs traverse
-8.06 probe to probe
-4.73 to DCS

TOPS
35500

IP7021802

8-14-07

F pulv 90% Fdr @ ~~15:00~~ 15:00

@ 15:05	227,800	316	28.74	2.18	port 1
	225,800	310	28.67	2.13	port 2
	232,100	308	28.70	2.25	port 3
	224,500	313	28.68	2.11	port 4
	234,200	306	28.70	2.28	port 5
	234,300	312	28.73	2.27	port 6
	231,800	316	28.73	2.24	port 7
	233,200	314	28.71	2.28	port 8
@ 15:45	230,900	313	28.68	2.22	port 9

Flow vs traverse
- 8.26

Compare to DCS
- 5%

ave PI 231.18

traverse ± 7% 5% human 2% system error
7.5%

8-15-07

G pulv 70% Fdr @ 8:10 in manual 5% air bias

@ 8:15	227,900	278	28.36	2.19	port 1
	231,400	269	28.42	2.12	port 2
	232 300	269	28.42	2.17	port 3
	229 300	269	28.39	2.12	port 4
	230 500	269	28.43	2.13	port 5
	232 500	270	28.38	2.16	port 6
	228,500	276	28.43	2.11	port 7
	229,900	269	28.42	2.11	port 8
@ 8:55	230,900	269	28.42	2.15	port 9

PI ave 229,900
- 4.85%

last time probe to probe
50% - 2.8
90% - 2.5

241 615

Still @ 70% with 5% air bias out

09:05 215,300 276 28.46 1.87

90% Fdr Speed 5% air bias ≈ 09:07

@ 9:10	240,700	292	28.33	2.46	port 1
	243,800	305	28.37	2.52	port 2
	245,500	318	28.34	2.60	port 3
	240,000	311	28.30	2.45	port 4
	248,100	292	28.40	2.58	port 5
	246,600	308	28.33	2.59	port 6
	248,800	316	28.38	2.66	port 7
	250,300	315	28.36	2.68	port 8
@ 9:45	249,300	307	28.34	2.60	port 9

PI ave 245,229
- 5.02%

258,

device in Field 3% error

extra large
13% more port area than large

.8% wind tunnel ASME

IP7021803

H Pulv 8-15-07
70% 12:00

12:02	216,500	295	28.74	1.98	port 1	
	215,000	292	28.77	1.95	port 2	
	214,300	287	28.79	1.90	port 3	
	205,800	291	28.81	1.81	port 4	
	213,200	269	28.60	1.86	port 5	
	214,500	293	28.81	1.91	port 6	PI Ave
	215,400	281	28.77	1.92	port 7	214,822
	216,300	286	28.78	1.94	port 8	-5.1%
12:45	214,000	281	28.75	1.90	port 9	

~~-1.58~~ -1.55 last time

90% Fdr Speed H Pulv 12:55

12:58	227,600	326	28.75	2.27	port 1	
	227,900	324	28.69	2.28	port 2	PI Ave 230,834
	231,300	317	28.69	2.28	port 3	
30 sec rolling average	221,500	319	28.63	2.15	port 4	
	234,600	311	28.70	2.38	port 5	-5.3%
	228,600	321	28.63	2.29	port 6	
	232,100	317	28.71	2.34	port 7	~~-1.55~~
	230,000	319	28.69	2.29	port 8	-1.38
13:35	232,300	317	28.66	2.33	port 9	last time

A Pulv
70% 5% air bias

has k factor

14:27	230,700	281	28.73	2.14	port 1	
	225,600	286	28.77	2.07	port 2	
PI Ave 229,872	229,900	285	28.78	2.14	port 3	
	228,500	286	28.74	2.12	port 4	
	231,600	286	28.76	2.14	port 5	-2.0%
	230,200	285	28.73	2.15	port 6	
	230,300	284	28.74	2.15	port 7	-1.8%
15:03	230,200	284	28.76	2.15		last time

A - 85% Fdr 5% bias 15:10

@ 15:15	235,700	314	28.72	2.39	port 1	
	236,700	308	28.72	2.40	port 2	
PI Ave 240,655	242,200	309	28.74	2.46	port 3	-1.3%
	237,200	300	28.73	2.34	port 4	
	245,400	305	28.68	2.48	port 5	-2.0%
	241,300	305	28.71	2.43	port 6	last time

15:42 mill tripped on accident by I+C

port 7
port 8
port 9

Tops

IP7021804

U2 B Pulv 8-16-07 1% Change air per 10 °F

70% Fdr speed 7:45

7:47 ~~7:45~~ 7:47	214,900	269	28.74	1.90	port 1 N	
	217,300	273	28.72	1.95	port 2	
	214,900	274	28.79	1.91	port 3	PI ave
	214,300	274	28.79	1.90	port 4	214,755
	215,400	274	28.79	1.91	port 5	
	215,900	271	28.82	1.93	port 6	-5.6%
	214,900	273	28.79	1.91	port 7	
	215,500	275	28.78	1.91	port 8	
8:25	214,700	268	28.81	1.90	port 9 S	

B 90% 8:30

Start 835	228,400	289	28.77	2.23	port 1	
	230,300	292	28.73	2.25	port 2	
	231,100	297	28.78	2.28	port 3	PI ave
	226,600	297	28.73	2.21	port 4	231,093
	235,400	297	28.75	2.36	port 5	
	233,700	295	28.78	2.28	port 6	-5.1%
	231,000	295	28.77	2.28	port 7	
	233,800	296	28.75	2.34	port 8	
9:12	231,900	297	28.76	2.29	port 9	

C pulv 70% 8-16-07

Start 10:10 PI Ave 214,695

end 10:45

-4.03%

C 90% Fdr 10:50

10:55	223,800	314	28.87	2.13	port 1
	226,100	310	28.85	2.17	port 2
PI Ave 223,630	226,000	310	28.85	2.17	port 3
	221,500	309	28.88	2.07	port 4
-3.4%	222,500	303	28.81	2.09	port 5
	225,400	307	28.91	2.13	port 6
	222,300	310	28.91	2.09	port 7
	222,900	308	28.93	2.06	port 8
11:28	222,900	307	28.93	2.04	port 9

TOPS 35500

IP7021805

10:07	215 600	286	28.90	1.86
	212.500	284	28.88	1.88
:11	214 800	287	28.88	1.91
:16	212,000	284	28.86	1.85
:22	215 700	287	28.85	1.92
26	214 200	288	28.83	1.89
31	214 900	290	28.93	1.90
35	216 800	289	28.92	1.95
39	215400	290	28.87	1.92
10:45				

C Pulv 70%

IP7021806

8-16-07

U2 D Fdr 70% 6% air bias

12:55	234,500	263	28.74	2.18	port 1 N
	229,000	269	28.73	2.10	port 2
	233,400	263	28.74	2.17	port 3
	226,300	263	28.69	2.03	port 4
	235,200	261	28.68	2.20	port 5
	231,400	261	28.74	2.11	port 6
	233,200	266	28.74	2.15	port 7
	235,800	262	28.74	2.14	port 8
13:32	231,800	263	28.68	2.13	port 9

K 1.083

PI Ave 232,562 -2.7%

If K 1.143
Should read 239,000
went to ≈ 239,600

223386

traverse @ same pt_{air}
D 70% 6% bias

14:00	231,000	262	28.70	2.11	port 1
	230,300	260	28.71	2.09	port 2
	234,900	260	28.68	2.17	port 3
	228,400	257	28.69	2.07	port 4
	237,200	255	28.73	2.12	port 5
	232,200	259	28.64	2.13	port 6
					port 7
	232100	263	28.68	2.15	port 8
14:35	234,900	260	28.71	2.18	port 9

PI Ave 232,802 -3.1%

1st 240,258 traverse
2nd 237,019

wt 26 104-21-7
wt 46 25-20-14
wt 42 23-18-10

223,885 - DCS
Cams

Probe -6.5
-6.81

IP7021807

	U2 Mill, T		Gain	Bias %	Alternate Gain, Bias	
ON	A	2SGB-FT-75	1.041	0.0	1.015, 1.93	1.095
ON	B	2SGB-FT-76	1.050	.21	1.050, 0.21	
ON	C	2SGB-FT-77	1.078	0.0		
ON	D	2SGB-FT-78	1.083	0.0		
'FF	E	2SGB-FT-79	1.086	0.0		
ON	F	2SGB-FT-90	1.1	0.0		
ON	G	2SGB-FT-91	1.09	0.0		
ON	H	2SGB-FT-92	1.070	0.0	1.109, -2.57	

7. Enhanced Display Config
   - Line 1 - Filter 2
   - Line 2 - Parameter Temp
   - Line 3 - Parameter Abs Pres
   - Line 4 - Parameter Diff Press

8. Analog Output Config
   - Output 4 Selec - Transmitter DP

9. Transducer Span Selection -
   - Xdcr Natural Span 10.00 in.WC
   - Xdcr Operating Span - 6.801 in WC for 300,000 lbm/hr
   - (Calc from Mass Flow spreadsheet, set at highest temp and lowest pressure)

10. Transmitter Input Calib
    - Transducer Zero Calib - 0.00 in.WC
    - Transducer Span Calib - 10.00 in WC

11. Transmitter Ouput Calib (Don't enter this menu when ONLINE, high risk of tripping mill)
    - Output 1 Zero - Perform Calib
    - 1 Span - Perform Calib
    - 2 Zero - Perform Calib
    - 2 Span - Perform Calib
    - 3 Zero - Perform Calib
    - 3 Span - Perform Calib
    - 4 Zero - Perform Calib
    - 4 Span - Perform Calib

12. Xducr Characterization - depends on Xducer calib
    - Data Point 1 - -10 3
    - Data Point 2 - 2,500 2518
    - Data Point 3 - 5,000 5017
    - Data Point 4 - 7,500 7522
    - Data Point 5 - 10,001 10,049

Air Monitor CAMS Setup Parameters
Primary Air Flow Updated 14 June 2007

U2 = Veltron IIB CPU board 4.40A 10601 800 Rev C

1. Transmitter Scaling and Config

Process Config

Density Comp	-	ON
Density Comp Type	-	Mass
Temp/Press	-	Temp & Abs press
Process Type	-	Transmitter Flow
Process Units	-	Flow lb/hr
Process Format	-	Flow XXXX, X00 lb/hr
Process Minimum	-	Flow 00 lb/hr
Maximum	-	300,000 lbm/hr
Duct Area Units	-	Square Feet
Duct Area Range	-	0 - 32.5 sq/ft
Duct Area	-	10.083 sq/ft
Temperature Units	-	°F
Barometric Pres Units	-	in. Hg
Output Lockdown	-	10.0% FS output
exit		

Temp Config

Input Linearization	-	OFF
Minimum Temperature	-	0°F
Maximum Temperature	-	600°F
Default Temp	-	350°F
Temp Fault Output	-	Default Temp
exit		

Absolute Pressure Config

Min Abs Pressure	-	24 in.Hg
Max Abs Pressure	-	32 in.Hg
exit		

Calculator for Max Flow

Calculate DP/Flow	-	Diff Press
Standard Temperature	-	68°F
Process Temperature	-	68°F
Static Pressure Units	-	in.WC
Process Static Press	-	0.0 in.WC
Bar Pres or Elevt'n	-	Barometric Pressure
Barometic Pressure	-	29.92 in.Hg - measurement
Wet/Dry Flow Basis	-	WET
Percentage Water	-	0.00%
Dry Molecular Weight	-	28.966 lb/lb mole
Pitot Tube Coeffic-	-	1.0
Calculate Diff Pres	-	2.717 in.WC - measurement

Update Operating Span - NO
Reset Calc Default Values - NO
exit

Return to Main

2. Low Pass Filter Selection
   Low Pass filter - 4

3. Auto-Zero Config
   Auto-Zero Off/On Select - ON
   Auto-Zero Interval - U2 = 4 hr, U1 = 4 hr

4. Auto-Purge Config
   Auto-Purge Off/On Select - ON
   Auto-Purge Activtn Select - Internal Only or Internal + external
   Auto-Purge Interval - $\boxed{\text{23.65 hr = H}}$

MILL	PURGE INTERVAL
A	24.00 HR
B	23.95
C	23.9
D	23.85
E	23.8
F	23.75
G	23.7
H	23.65

   Purge Duration - 1.0 Min
   After Purge Duration - 1.0 Min

5. Special Function Config
   Special Function Off/On - OFF
   Function Type - `Summed Flow
   External Input Max - 00 lb/hr

6. K -Factor Config
   K-Factor Off/On - ON U1 = OFF
   Calc K-Factor ? - NO
   K-Factor Gain - 1.070 = H U1 = 1.000
   K-Factor Bias - 0.0% = H U1 = 0.0

Unit 2 K Factor Table

U2 Mill, T	Gain	Bias %	Alternate Gain, Bias
A 2SGB-FT-75	1.041	0.0	1.015, 1.93
B 2SGB-FT-76	1.050	.21	1.050, 0.21
C 2SGB-FT-77	1.078	0.0	
D 2SGB-FT-78	1.083	0.0	
E 2SGB-FT-79	1.086	0.0	
F 2SGB-FT-90	1.1	0.0	
G 2SGB-FT-91	1.09	0.0	
H 2SGB-FT-92	1.070	0.0	1.109, -2.57

7. Enhanced Display Config
   - Line 1 - Filter 2
   - Line 2 - Parameter Temp
   - Line 3 - Parameter Abs Pres
   - Line 4 - Parameter Diff Press

8. Analog Output Config
   - Output 4 Selec - Transmitter DP

9. Transducer Span Selection -
   - Xdcr Natural Span 10.00 in.WC
   - Xdcr Operating Span - 6.801 in WC for 300,000 lbm/hr
   - (Calc from Mass Flow spreadsheet, set at highest temp and lowest pressure)

10. Transmitter Input Calib
    - Transducer Zero Calib - 0.00 in.WC
    - Transducer Span Calib - 10.00 in WC

11. Transmitter Ouput Calib
    (Don't enter this menu when ONLINE, high risk of tripping mill)

Output	1 Zero	-	Perform Calib
	1 Span	-	Perform Calib
	2 Zero	-	Perform Calib
	2 Span	-	Perform Calib
	3 Zero	-	Perform Calib
	3 Span	-	Perform Calib
	4 Zero	-	Perform Calib
	4 Span	-	Perform Calib

12. Xducr Characterization - depends on Xducer calib

Data Point 1	-	-10	3
Data Point 2	-	2,500	2518
Data Point 3	-	5,000	5017
Data Point 4	-	7,500	7522
Data Point 5	-	10,001	10,049

		U2		U1				U2		U1
	S/N	Xducr Characterization					S/N	Xducr Characterization		
Pulv A		0	Data 1	0		Pulv E	B26698	0	Data 1	0
		2530	Data 2	2520				2470	Data 2	2356
		5070	Data 3	5040				4950	Data 3	4873
		7590	Data 4	7580				7410	Data 4	7385
		10150	Data 5	10008				9910	Data 5	9917
				2520						
Pulv B		-10	Data 1	5040		Pulv F		0	Data 1	-10
		2510	Data 2	7560				2520	Data 2	2490
		5040	Data 3	10008				5030	Data 3	4990
		7560	Data 4	7500				7530	Data 4	7500
		10110	Data 5	10001				1007 0	Data 5	10000
Pulv C		0	Data 1	0		Pulv G		0	Data 1	-10
SN	82689 6	2530	Data 2	2480				2500	Data 2	2480
		5030	Data 3	4970				4980	Data 3	4960
		7530	Data 4	7460				7450	Data 4	7450
		10070	Data 5	9590				9960	Data 5	9940
Pulv D		0	Data 1	0		Pulv H		-10	Data 1	-10
	82669 4	2490	Data 2	2470				2480	Data 2	2550
		4960	Data 3	4930				4980	Data 3	5000
		7420	Data 4	7400				7470	Data 4	7520
		9900	Data 5	9860				9990	Data 5	10003

13. Display Internal Temp - 87°F - measurement exit

```
PURCHASING                PO STATUS INQUIRY - PO DETAIL                  PU4044
    PO Number             08-62749     Purchase Priority 4          ROUTINE

    Buyer                 28093 LARSEN, J
    Line                    1
    WO Number                                    Equip No
    Crew No                81                    Date Required     08/09/07
    Stock Number          DIRECT                 Account No        00-6525-503
 1: Item Description      TESTING, PRIMARY AIR TRAVERSE, UNIT 2 PULVERIZER
                          INLET, BY AMC POWER, A DIVISION OF AIR MONITOR
    Requisition Cost      CORPORATION; ESTIMATE OF ONE (1) WEEK TESTING,
     8,100.00000          TENTATIVE START DATE OF AUGUST 13, 2007

    Commodity Code        999999                 Actual Cost       TO BE ADVISED
    Unit Measure   PUR    WK   ISS WK            Trade Disc (% $)
    Conversion            1    TO  1             Amount
    Quantity Required     1        1             Result
    Taxable (Y/N)         Y                      Matl at Vendor
    Scheduled Delivery    08/20/07               Std Freight Rate
    Deliver To            Garry Christensen
 2: General Notes         PO for one week primary air traverse testing on
                          Unit 2.  Test start date Aug 13th
WHICH ONE (C=CONVERSION, V=VOUCHER, N=NOTES, P=PAY, <RTN>=CONTINUE) ?
D70371 16:03 08 OCT 2007     Intermountain Power Service Corp.    USER.LIVE.DATA
```

From: "Matt Maragos" <mmaragos@airmonitor.com>
To: "'Garry Christensen'" <Garry-C@ipsc.com>
Date: 8/8/2007 12:08 PM
Subject: RE: Req has been signed

CC: "'Dean Wood'" <Dean-W@ipsc.com>, "'Jerry Finlinson'" <Jerry-F@ipsc.com>,...

Garry,

Dan Beistel will be the AMC technician coming to the jobsite to perform the work. He has been to Intermountain previously. Dan will confirm his schedule with you once he completes his travel arrangements. I expect Dan will be onsite no later than first thing Tuesday morning.

Ken and I are planning on being onsite Wednesday morning and possibly part of Thursday. I would like to spend some time reviewing the PA data with you.

I also want to evaluate the IBAM systems and data. Given a little bit of time and some raw data from the IBAMs, I believe that I can demonstrate to you the value and benefits of the individual burner airflow measurements and implementing them into an optimization control strategy.

Thank you.

Sincerely,

Matt Maragos
AMC Power, a division of Air Monitor Corporation
PH: 707-521-1731

-----Original Message-----
From: Garry Christensen [mailto:Garry-C@ipsc.com]
Sent: Wednesday, August 08, 2007 9:59 AM
To: Matt Maragos
Cc: Dean Wood; Jerry Finlinson; Jerry Hintze
Subject: Req has been signed

Matt, the req got approved and is in purchasing hands. The testing is a go. Please let me know who is coming for sure so I can get them approved at the guard gate. Thanks also for the papers. I will read them this afternoon.

Intermountain Power Service Corp.
Performance Engineer
850 W. Brush Wellman Road
Delta, Utah 84624-8546
garry-c@ipsc.com (mailto:garry-c@ipsc.com)
Telephone (435) 864-6486